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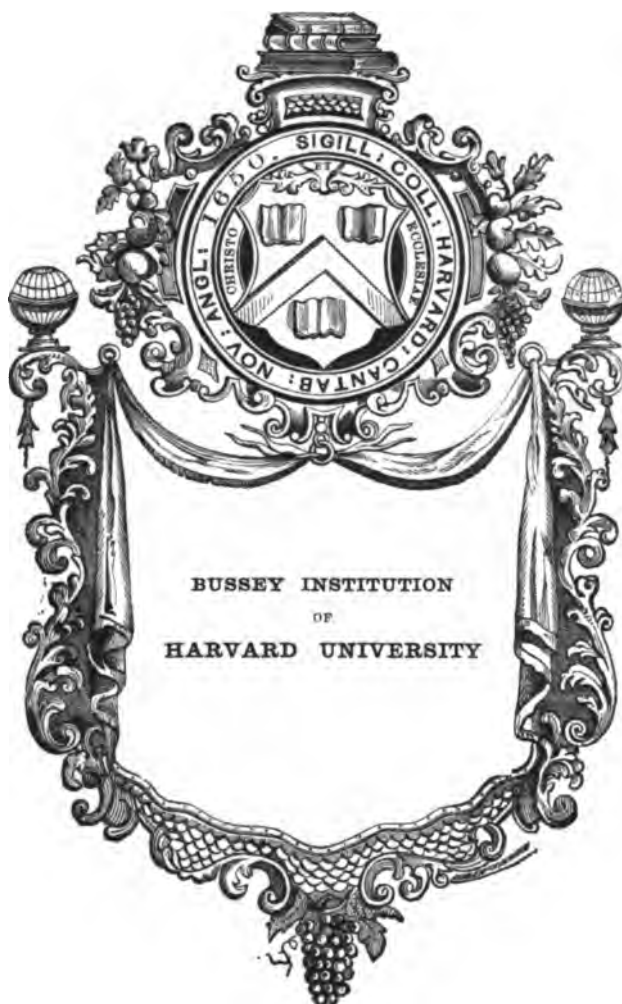
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**TWELFTH ANNUAL REPORT**

**OF THE**

**STATE BOARD OF AGRICULTURE**

**OF THE**

**STATE OF MISSOURI**

**FOR THE YEAR 1876.**

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**EDITED BY**

**JOHN MONTEITH, SECRETARY.**

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**JEFFERSON CITY:**

**REGAN & CARTER, STATE PRINTERS AND BINDERS.**

**1877.**

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*To the General Assembly of the State of Missouri :*

In pursuance of section eight of article one, chapter four of Wagner's Statutes of Missouri, entitled "Of Agricultural Societies," I have the honor to transmit herewith the Transactions of the State Board of Agriculture for the year 1876.

Very respectfully,

JOHN MONTEITH,

*Secretary.*

**LAWS CONCERNING THE STATE BOARD OF AGRICULTURE  
AND COUNTY AGRICULTURAL AND MECHANICAL SOCIETIES.**

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G. S. Ch. 159, § 1—1. A Board of Agriculture is hereby instituted and created a body corporate, by the name and style of the "Missouri State Board of Agriculture," and by that name shall have perpetual succession; power to sue and be sued; complain and defend in all courts; to make and use a common seal, and to alter the same at pleasure.

IBID, § 2—2. The persons named as corporators of the Missouri State Board of Agriculture heretofore existing, and the duly elected officers thereof, are hereby constituted the officers and members of the Board of Agriculture hereby created, until their successors shall be duly elected and qualified.

IBID, § 3—3. The Missouri State Board of Agriculture shall, at their next annual meeting, in addition to filling the vacancies then occurring, elect two additional members, and the Governor of the State and the Superintendent of Public Schools shall be *ex-officio* members of the Board. Immediately after the State Board of Agriculture has been increased to twelve elected members, as herein provided, said twelve members shall, by themselves and by lot, be divided into three classes of four each, numbered one, two and three. The term of service of class number one shall expire at the annual meeting in 1867; of class number two at the annual meeting in 1868, and of class number three in 1869; and at the annual meeting in 1867, and at each annual meeting thereafter, there shall be elected four members for the term of three years, to fill the vacancies occurring by expiration of term of service, and any vacancies occurring in unexpired terms of service shall be filled by election for the unexpired term. In case of failure by the President or delegates of County Agricultural Societies to fill vacancies at the annual meeting, the Board shall have power to fill the same by election.

IBID, § 4—4. The officers of said Board shall be a President, Secretary and Treasurer, and such other officers as said Board shall deem necessary, who shall be elected at the annual meeting thereof, and shall serve for one year, and until their successors are duly elected and prepared to enter upon the duties of their respective offices.

IBID, § 5—5. The Missouri State Board of Agriculture, and their successors, shall have the power to adopt such by-laws and make such rules and regulations for the government of said Board and the management of its affairs and business as they may deem best calculated to promote the interests of agriculture, and as shall not be inconsistent with the Constitution and laws of the State of Missouri and of the United States.

IBID, § 6—6. There shall be held in the city of St. Louis, on the first Wednesday of December of each year, an annual meeting of the Board of Agriculture, together with the President of each County Agricultural Society, or other delegates therefrom duly authorized, who shall, for the time being, be *ex-officio* members of the State Board of Agriculture, for the purpose of deliberation and consultation as to the wants, prospects and condition of the Agricultural interests of the State; to receive the reports of the District and County Societies, and to fill by elections all vacancies in the State Board of Agriculture. The President also shall have power to call meetings of the Board whenever he may deem it expedient, and at any meeting of said Board seven members thereof shall constitute a quorum for the transaction of business.

IBID, § 7—7. It shall be the duty of all Agricultural and Horticultural Societies, organized and established in accordance with the laws of this State, to make a full report of their transactions to the Missouri State Board of Agriculture at each annual meeting thereof.

IBID § 8—8. It shall be the duty of the said Board to make an annual report to the General Assembly of the State, embracing the proceedings of the Board for the past year, and an abstract of the reports and proceedings of the several agricultural and horticultural societies, as well as a general view of the condition of agriculture and horticulture throughout the State, accompanied by such recommendations, including especially such a system of public instruction upon those subjects as may be deemed interesting and useful.

IBID, § 9—9. The sum of one hundred dollars is hereby appropriated out of any moneys not otherwise appropriated for the uses of the Board, and an account of the expenditures of the Board shall be included in the annual report to the General Assembly.

IBID, § 10—10. The Public Printer shall, annually, under the direction of the President of the State Board of Agriculture and the President of the State Horticultural Society, print and bind, in one volume, six thousand copies of the Annual Report of the said Board of Agriculture and the proceedings of the State Horticultural Society; thirty-eight hundred copies to be for the use of the General Assembly, two hundred for the State Library, one thousand copies for the State Board of Agriculture, and one thousand copies for the State Horticultural Society, for distribution to the agricultural, horticultural and mechanical associations throughout the State.

#### AGRICULTURE—STATE BOARD OF—PUBLICATION OF REPORT.

AN ACT to amend section (10) of chapter fifty-nine of the General Statutes of Missouri, the same being section ten (10), of article one (1) of chapter four (4) of Wagner's Missouri Statutes, third edition, concerning "State Board of Agriculture."

*Be it enacted by the General Assembly of the State of Missouri, as follows :*

SECTION 1. Section ten of chapter fifty-nine of the General Statutes of Missouri is hereby amended so as to read as follows:

Section 10. The Public Printer shall, annually, under the direction

of the President of the State Board of Agriculture, print fourteen thousand copies, of which two thousand shall be in the German language, of the Annual Report of the said Board of Agriculture; five hundred copies to be bound in cloth, balance in paper covers, to be distributed as follows: Twenty copies to each member of the General Assembly; fifty bound copies to the State Library; thirty copies to each county clerk for distribution among the farmers, as generally as may be, and the remainder to the State Board of Agriculture, to be distributed among the several Agricultural and Horticultural Societies and Farmer Clubs of this State and other States, as the Board may direct: *Provided*, That said Annual Report shall not contain more than five hundred pages.

SEC. 2. All acts and parts of acts inconsistent with this act are hereby repealed.

SEC. 3. This act to take effect and be in force from and after its passage.

Approved March 24, 1875.

#### APPROPRIATIONS: BOARD OF AGRICULTURE.

*Be it enacted by the General Assembly of the State of Missouri, as follows:*

SECTION 1. There is hereby appropriated out of any money in the State Treasury, not otherwise appropriated, the sum of four thousand dollars, annually, for the benefit of the State Board of Agriculture, and the sum of one thousand dollars (\$1,000) is hereby appropriated for the State Horticultural Society, to be paid to the Treasurer thereof quarterly.

SEC. 2. The sum mentioned in the first section of this act shall be paid to the President of the State Board of Agriculture, in quarterly installments, upon the warrant of the State Auditor, drawn in favor of the President of said Board upon the State Treasurer for such quarterly installments: *Provided*, That after the payment of the first quarterly installment the State Auditor shall not draw his warrant upon the State Treasurer for the succeeding quarterly installments respectively, until the President of the State Board of Agriculture shall have filed in the office of the State Auditor good and sufficient vouchers, showing the proper expenditures of the preceding installment, in accordance with the objects of said Board.

SEC. 3. This act to take effect and be in force from and after its passage.

Approved March 18, 1871.

#### COUNTY AGRICULTURAL AND MECHANICAL SOCIETIES.

ACTS 1867, p. 3—1. Whenever fifty freeholders within this State shall present a petition to the county court of the county in which they or a majority of them reside, setting forth that they desire to organize and be incorporated for the purpose of promoting improvements in agricultural manufactures and the raising of stock, and the



court shall be satisfied that such persons are freeholders of this State, the court shall, by an order, declare the petitioners incorporated for the purposes specified in this section; and thenceforth the petitioners shall be a body politic and corporate by the name and style of the (naming it) County Agricultural and Mechanical Society, and by that name they and their successors shall be known in law; have perpetual succession; sue and be sued; plead and be impleaded; defend and be defended, in all courts and in all actions, pleas and matters whatsoever; and shall have power to purchase, hold and receive any quantity of land not exceeding one hundred acres, with such buildings and improvements as may be placed thereon, and any other property not exceeding in value fifty thousand dollars; and may, by vote, determine that thereafter the members of said Society shall be composed of such persons as shall subscribe at least one share to the capital stock thereof in shares not exceeding twenty-five dollars each; said shares to be personal property and transferrable by agreement; but no transfer shall be binding on the Society until reported to and approved by the Board of Directors. The amount of such capital stock shall, from time to time, be fixed by the stockholders or Board of Directors, provided the same shall at no time exceed one hundred thousand dollars; and may convey, lease, sell and dispose of the property of the Society, or any part thereof, for the benefit of the Society, and may have a common seal, and break and alter the same at pleasure.

G. S. Ch. 60, § 2—2. Within thirty days from the date of the order of the county court, any number of the petitioners, exceeding twenty, may proceed to organize such Society by electing nine Directors, who shall hold their offices one year, and until their successors are elected; and the Directors, when so elected, shall collectively form a Board for the government of such Society, and in such Board shall be vested all the corporate powers and duties of every Society incorporated as provided in this chapter: and for the purpose of electing the Directors, there shall be held annually a general meeting of the members of the Society. All vacancies in the Board of Directors shall be filled by appointment of the Board. No person, not a member of the Society, shall be a Director.

IBID, § 3—3. Every Board of Directors shall assemble within twenty days after their election, and choose a President of their number, and some other person as Secretary, Treasurer, Collector, and such other officers, servants and agents as may be necessary; remove them from office and prescribe their duties; and all proceedings of the Board shall be public.

IBID, § 4—4. It shall be the duty of the President to preside at all meetings of the Board and of the Society, and in case of his absence, such other person as the members present shall appoint; and it shall be the duty of the Secretary to keep a record of the proceedings of the Directors and of the Society; and the Treasurer shall give bond and security, to the acceptance of the Board of Directors, for the benefit of the Society, in such sum as they, or a majority shall determine, conditioned that he will faithfully receive and pay over, on their order, all moneys and other articles, the property of the Society, that may come into his hands as Treasurer, which bond shall be deposited with the Secretary of the Board of Directors; and the said Treasurer shall keep fair and accurate entries of all moneys and other articles by him received as Treasurer, and from whom received, and to

whom and for what purpose paid out, and make report of the financial operations of his office, as often as he may be directed by the Board of Directors.

IBID, § 5—5. The said Board, a majority of whom shall form a quorum, shall have power to make, ordain and adopt a constitution and all necessary by-laws, ordinances, rules and regulations for the government of the Board of Directors and of the Society, and for the promotion of the objects for which it is designed; and the President of the Board shall cause the same to be carried into effect; provided such constitution, by-laws, ordinances, rules and regulations shall not be inconsistent with the Constitution and laws of this State.

IBID, § 6—6. All moneys paid by members and others, and donations made to the Society, shall be appropriated under the direction of said Board, in conformity to such constitution, by-laws, rules and regulations as may be ordained and established for the government of the Society and for the advancement and encouragement of the objects of the Society.

IBID, § 7—7. The county court of any county, in which there shall be a Society organized according to this chapter, or any special act of incorporation, shall have the power, and may, if it shall be deemed expedient, appropriate out of the county treasury for the benefit of the Society, the sum of one hundred and fifty dollars in any one year; and the money so appropriated shall be drawn by the Treasurer of the Society in a proper warrant; *Provided*, Said money shall be annually awarded by the Board of Directors in premiums, or expended by them in the purchase of premiums, to be known as "The (name the county) County Court premiums," to be awarded according to the rules, regulations and by-laws of the Society; *and provided further*, That not more than one such premium shall be awarded to the same animal or article on exhibition by the same county society.

IBID, § 8—8. At each annual meeting of the Society, the Board of Directors shall report, in writing, the number of members and the financial condition of the Society; the quantity and character of the property owned by it, and the quality and cost of improvement of the same; the number and value of premiums awarded at their annual fair; the number and character of animals and articles exhibited; a statement of the probable quantity of the staple commodities of the county, and prices current thereof, and such other information in relation to the agricultural and mechanical interests of the county as they may deem worthy of general notice; and a copy of the report so made shall be transmitted to the Board of Directors of the Missouri State Agricultural Society (Missouri State Board of Agriculture,) to be disposed of as provided in the next succeeding section of this chapter.

IBID, § 9—9. The Board of Directors of the Missouri State Agricultural Society, (Missouri State Board of Agriculture) shall, at each session of the General Assembly of the State of Missouri, report faithfully all the facts, statistics and information contained in the reports transmitted to them from the county agricultural and mechanical societies organized and incorporated under the provisions of this chapter, and such other facts, statistics and information as they may gather from other counties in this State in regard to agricultural, mechanical and domestic manufactures and productions, and to the raising of the various breeds of stock.

IBID, § 10—10. The land and other property which may be held

by any Society under the provisions of this chapter, shall be held by the Society for the sole purpose, and none other whatsoever of erecting inclosures, buildings and other improvements, calculated and designed for meetings of the Society, and for exhibitions of various breeds of horses, cattle, mules and other stock, and of agricultural, mechanical and domestic manufactures and productions, and for the purchase and importation and the keeping thereof of such foreign breeds of stock as the Board of Directors may deem advantageous to the interests of the county.

IBID, § 11—11. The members of any Society, organized under the provisions of this chapter, shall be composed of such persons, and none others, as shall have subscribed their names as such in the books in which the proceedings of the Society and of the Board of Directors are or shall be recorded, and paid annually to the Treasurer of the Society such sum, not exceeding five dollars in any one year, as may be established by the rules, by-laws and regulations of the Society as a membership fee; and such persons shall be members only for the year for which he shall have paid such fee.

IBID, § 12—12. A duly authenticated copy of the order of the county court provided for in section one of this chapter, shall be filed and recorded in such manner as conveyances of land are by law directed to be recorded in the office of the recorder of the county, within three months after such order shall be made.

IBID, § 13—13. The constitution, by-laws, rules and regulations of the Society and Board of Directors, shall be printed and circulated among the members of the Society within thirty days after their adoption.

IBID, § 14—14. Whenever a majority of two-thirds of the members of any Society organized under the provisions of this chapter, shall, at an annual meeting, declare such Society dissolved; or if, from any other cause, said Society shall be dissolved or fail to meet and pursue the objects of the Society for the period of five consecutive years, then the real estate and all other property held by it shall be sold for cash in hand, at public auction, before the court house door of the county, after thirty day's notice given in some newspaper published in the county, if there be one, and if not, by ten printed advertisements set up in ten public places in the county, describing the property to be sold, and the time, place and terms of sale. Such sale shall be conducted by the Directors or a majority of them, chosen and elected as provided by this chapter.

IBID, § 15—15. At any fair, show or exhibition, held by an incorporated Agricultural and Mechanical Society, every person who shall, without the permission of the officers of such Society, enter within any inclosure which may be used by such Society as an agricultural and mechanical fair, and every person guilty of disorderly conduct, or such conduct as may interrupt or be prejudicial to the interests of such fair or exhibition whatever, within the inclosure for same, or at a distance within two hundred yards of such inclosure, shall be liable to immediate arrest by any officer of such Society, and to the payment of five dollars to the Society holding such fair, show, or exhibition, to be recoverable at the suit of such Society before any justice of the peace of the county in which such fair, show or exhibition may be held.

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IBID, § 16—16. All agricultural societies in this State, established under the act above cited, and that have failed to keep up their organization, as required by the law approved November 23, 1855, are hereby authorized and empowered to pursue the objects of such societies and perpetuate their organizations as though no failure to observe the law had occurred.

## BY-LAWS.

**SECTION 1.** The officers of the Missouri State Board of Agriculture shall consist of a President, Vice President, Treasurer and Secretary.

**SEC. 2.** It shall be the duty of the President to preside at the meetings of the Board, to sign all warrants on the Treasurer ordered by the Board, and to perform such other duties as are or may be required by law. He shall be *ex-officio* Chairman of the Executive Committee. In his absence, the Vice President shall perform his duties.

**SEC. 3.** It shall be the duty of the Secretary to keep and preserve the minutes and records of the Board and the proceedings of the Executive Committee, to furnish a copy of the same for publication previous to the expiration of his term of service, and to countersign all warrants on the treasurer for money.

**SEC. 4.** The Treasurer shall keep the funds of the Board and pay all warrants drawn by order of the Board, signed by the President and countersigned by the Secretary, and shall make his report at the annual meeting in December of his receipts and expenditures; from whence received and to whom paid, properly arranged for publication. He shall give bond in such penal sum as may be required by the Board for the faithful performance of his duties and the payment of all moneys in his hands.

**SEC. 5.** It shall be the duty of the Secretary to conduct all correspondence with societies and individuals; to issue such circulars for obtaining statistics or other information as the Board may direct, or as may be deemed expedient or useful; to collate and arrange the correspondence, proceedings of the Board, and the proceedings of the county societies for report and publication as required by law, and distribute to county societies and others entitled to them, all seeds, plants, publications, etc., which may be acquired by the Board for distribution. His term of office shall hereafter commence the first day of February, and continue one year and until his successor is elected.

**SEC. 6.** The annual election for officers of the Board shall be held as early as possible after the adjournment of the annual December meeting. The officers then elected, except the Secretary, shall hold office from the first of January following and until their successors are elected.

**SEC. 7.** The President, Vice President and Secretary shall constitute an Executive Committee, whose duty shall be to inspect and audit all accounts, and to perform such other duties as may be required of them in the intervals between the meetings of the Board.

**SEC. 8.** The necessary expenses of the officers and corporate members in attending meetings of the Board shall be paid out of the treasury.

**SEC. 9.** The President shall have authority to call special meetings of the Board whenever he may deem it necessary or important to do so.

**SEC. 10.** Five of the corporate members shall be necessary to constitute a quorum at all meetings except the annual meetings.

**SEC. 11.** These by-laws may be altered or amended at any time by a majority of the members present and voting: *Provided*, That any member proposing to amend the by-laws at any meeting of the Board, shall give two weeks notice prior to said meeting to all the incorporate members or their successors in office, of such intended motion to amend.

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**PROCEEDINGS**  
**OF THE**  
**STATE BOARD OF AGRICULTURE,**  
**AT ITS ANNUAL MEETING IN DECEMBER, 1876.**

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## MEMBERS OF THE BOARD FOR 1877.

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JOHN S. PHELPS, Gov. of Missouri, (ex-officio member).....	Jefferson City.....	Cole county.
R. D. SHANNON, State Superintendent Public Schools, (ex-officio member).....	Jefferson City.....	Cole county.
JOHN W. HARRIS, President.....	Rocheport.....	Boone county.
HENRY T. MUDD, Vice-President.....	Kirkwood.....	St. Louis county.
NORMAN J. COLMAN.....	St. Louis.....	St. Louis county.
LUMAN A. BROWN .....	Boonsboro.....	Howard county.
M. V. L. McCLELLAND.....	Wellington.....	Lafayette county.
G. W. KINNEY.....	Foristelle.....	St. Charles county
GEORGE HUSMANN.....	Sedalia .....	Pettis county.
JOSIAH TILDEN.....	Carthage.....	Jasper county.
WILLIAM STARK.....	Louisiana.....	Pike county.
J. L. McCULLOUGH.....	Gentryville.....	Gentry county.
EDWIN DOUGLASS.....	Pevely .....	Jefferson county.
D. L. HALL.....	Kansas City.....	Jackson county.
C. V. RILEY, STATE ENTOMOLOGIST.....		St. Louis.
W. T. ESSEX, TREASURER.....		St. Louis.
JOHN MONTEITH, SECRETARY,.....		St. Louis.

# REPORT.

## FIRST DAY.

OFFICE OF MISSOURI STATE BOARD OF AGRICULTURE, }  
December 6, 1876.

In accordance with the provisions of law, the State Board of Agriculture met on the first Wednesday of December, 1876.

*Present*—John W. Harris, President; Norman J. Colman, Luman A. Brown, Josiah Tilden, William Stark, J. L. McCullough, D. L. Hall, and Hon. R. D. Shannon, State Superintendent of Public Schools, member *ex-officio*.

On motion of Mr. Brown, the reading of the minutes of the last meeting was dispensed with.

On motion of Mr. McCullough, a Committee on Order of Business, consisting of three members was appointed, viz.: Messrs. McCullough, Dr. Shannon and Gov. Colman.

The following letter from Gov. Hardin was read and ordered to be spread upon the minutes:

STATE OF MISSOURI, EXECUTIVE DEPARTMENT, }  
CITY OF JEFFERSON, December 4, 1876.

JOHN MONTEITH, Esq., *Secretary, etc.*:

DEAR SIR: Owing to press of official business, I will not be able to attend the agricultural meeting, and regret that I cannot do so. The Society must excuse me, and you will please withdraw my name from the programme.

Your proceedings, if any, in regard to the Locust question will be read with interest by all.

Very respectfully,

C. H. HARDIN.

On motion of Mr. Hall, a Committee of three on Credentials of those representing agricultural societies, was appointed.

The President appointed Messrs. Hall, Brown and Stark.

The Board took a recess, to give the committees time to report.

On the call to order, the following report was made by the Committee on Order of Business:

MR. PRESIDENT: Your Committee on Order of Business would beg leave to report, and most respectfully suggest that the programme of exercises, arranged by the Executive Committee, be adopted as the order of business of the present ses-



sion, with this modification, namely: that the programme be taken up in order, and proceeded with till completed, without reference to days. We further suggest that time be allowed for brief discussions of each essay or address.

J. L. McCULLOUGH, Chairman.

The following is the order of business adopted:

Wednesday, December 6—Organization of the Board.

2. President's address—Hon. J. W. Harris.
3. Report of Secretary—John Monteith.
4. Report of Treasurer—W. T. Essex.
5. Report of State Entomologist—Prof. C. V. Riley.
6. Reports of committees—crop reports from members.
7. Agricultural Societies—Messrs. Hall and Tilden.
8. The Locust Plague—Gov. C. H. Hardin, Prof. Riley.

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1. Miscellaneous business.

2. Swine diseases—Gov. Colman, Hon. McClelland.

3. Grape prospect—Messrs. Husmann, Brown, Stark.

4. Stock law—Hons. H. T. Mudd, L. A. Brown, J. L. McCullough, John Walker.

5. Agricultural School—Hon. R. D. Shannon, President S. S. Laws, Prof. G. C.

Swallow.

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1. Miscellaneous business.

2. Practical poultry-keeping—W. H. Todd, Ohio.

3. The Dairy interests of Missouri—E. A. Filley, Esq.

4. Jersey cows and butter-making—E. Douglass.

5. Middle-men—Wm. Cam, Esq., Iron county.

6. Adjournment.

The Committee on Credentials made the following report:

**MR. PRESIDENT:** Your committee find credentials from the following agricultural associations:

From Sturgeon Agricultural and Mechanical Association—Maj. Jas. S. Rollins.

From Boone County Mechanical and Agricultural Society—Maj. Jas. S. Rollins, Prof. G. C. Swallow.

From Jefferson County Agricultural Society—Thos. A. Charles, Secretary.

Your committee will further report should other delegates arrive.

D. L. HALL,

WM. STARK,

L. A. BROWN,

Committee.

The report was adopted.

On motion, the Board adjourned to meet at 2 o'clock P. M.

## AFTERNOON SESSION.

*Present*—J. W. Harris, Norman J. Colman, Luman A. Brown, Josiah Tilden, William Stark, J. L. McCullough, D. L. Hall, R. D. Shannon and Hon J. R. Rollins, Prof. G. C. Swallow and T. A. Charles.

The President, Hon. J. W. Harris, delivered the following address :

### PRESIDENT'S ADDRESS.

*Gentlemen of the State Board of Agriculture :*

The year 1876, now almost brought to a close, has furnished but few points of special interest to our Department of Agriculture. For any farmer who lives on an average farm, and who has been industrious, the seasons have left little cause for complaint. For such a farmer, nature and Providence seldom fail to yield plenty to eat. As to agriculture, in the light of a business, yielding a fair remuneration for intelligent labor, or a reasonable interest upon the capital invested, the present outlook is far from encouraging. With corn at 20 cents a bushel, there is a paltry margin for the man who raises it with his own personal labor, and for the man who hires, there can be only positive loss. In the case of small grains and hay, prices during the year passed, have ruled low; freights have experienced little if any change for the better; and it is questionable whether, under the most favorable circumstances, the average farmer who depends upon raising and selling grain, has saved himself from loss. In the midst of his discouragements, however, the farmer has

### NOT FARED WORSE THAN OTHERS.

On the contrary, there are many things to make his condition better. If he has a farm and home unincumbered by debt, he is safe, for mother earth has not forgotten his necessary wants.

### THE CROPS.

The past year has given us a fair average of crops. Like the preceding, the present year has experienced more than the usual quantity of rain fall. The consequence has been a large and vigorous growth of vegetation, and a heavy crop of weeds. The farmer who has begun his work with "sun up," and tended his cultivated crops with untiring industry, has been rewarded with bounty, but the sluggard finds no mercy. The devil's tares will always get the start of him, and in his pale stunted crops and shrunken yield, he receives his just reward.

### WHEAT.

Generally speaking, the stand of wheat was remarkable. But just in the height of harvest season the frequent and copious showers of rain prevented the gathering of the crop until it suffered considerable damage. It is undoubtedly the fact that very little No. 1 wheat has been secured or sold. Nevertheless, the fine growth of the last crop has stimulated our farmers to a new trial, and a larger breadth of this grain has been sown the past season than for many previous years. Up to the present time, the young crop of wheat looks well.

### CORN.

Though the summer was unusually moist the yield of corn per acre will probably not turn out as great as the yield of 1875. The reasons for this are plain. The rains of

1875 developed an enormous quantity of weeds whose seed multiplied the quantity of this enemy into great strength the past summer. The wet weather of 1875 brought to the surface a large amount of plant food which had been hidden by previous seasons of drouth, and this food was consumed by the crop of that year leaving a smaller supply for the year just closed. In general the corn crop did better on upland and not so well as usual on lowland or bottom.

#### OATS.

Received a good start where they were sown early. The rains caused a fair growth of straw, but it is everywhere noticeable that the berry is small and the grain turns out chaffy and of light weight.

#### POTATOES.

The potato crop is sufficient to supply home want but not nearly so abundant or of so good quality as that of the previous year. Some disposition to rot has been found and it is quite likely prices will rule high during the coming winter and spring.

#### OTHER CROPS.

Hay has yielded well but the wet season of harvest brought down the quality and the market grade. The baling and shipping of hay, therefore, has not proved remunerative after deducting high freights, commissions and expenses for handling. Broom corn, flax seed, castor beans and other special crops have held their own. Tobacco yields a good average crop.

#### LIVE STOCK.

The habit of many of our farmers of transforming the products of the farm into meat has proved itself worthy of continuance and imitation. The evils of high freight tariffs and of impoverished lands are overcome more effectually by this method of husbandry than by any other. He is a lucky farmer who can make his grade short-horn steer at two years old weigh 1,000 pounds gross; and if the epidemic diseases do not defeat him he is fortunate who brings his shotes through a single winter and sends them to market with 250 or 300 pounds of live meat. The raising of stock is the most important branch of farming for the Western farmer to study. How to manage pastures, to improve breeds, to care for, and in general succeed with live stock—these are subjects that should occupy the most earnest attention of the Board of Agriculture. The increasing demand in Europe for American beef is among the most promising signs of the times.

There has not been much encouragement in the raising of horses. Prices have been low, sales slow, and the comparatively greater worth and less risk on mules have caused considerable depression in this branch of live stock.

The low rates of wool have depressed the business of sheep raising, to say nothing of the everlasting and apparently more valuable dog. It may be questioned, however, whether sheep-husbandry in many portions of the State, when conducted with care, will not on the average prove as remunerative as any other branch of farming, if the farmer will stick to it through thick and thin.

#### THE FARMER'S CAUSE.

For the past five years the general interests of farmers have come in for a large share of public attention. We have felt that we were in the hands of other interests; that we were oppressed and enslaved. Others fixed the prices of our products, and

dictated to us the rates of transportation. Our purchasing rates were correspondingly high. It was hard for us to get ahead, and our sons and daughters becoming discouraged, sought other fields of activity and left the farm. Well, we made a noise about our grievances, and much good has resulted. The iron hand that was upon us has relaxed. We are *recognized* at last as the wealth producers of the land, and many of our grievances have been redressed. The chief good resulting from this agitation, however, is the quickened activity among farmers themselves. We were chiefly responsible for our condition, because we lacked concert of action, and permitted other combined interests to trample upon us. Now, one word expresses our immediate relief, and that is *cöoperation*.

We have found too that if we were imposed upon, it was because we were weaker than our oppressors. Something has been done to make us stronger, but much more remains to be done.

Permit me therefore, in conclusion, to state some of the directions in which our farmers are to seek for relief. And, first, we need personally

#### A BROADER INTELLIGENCE.

Others will get the better of us just in proportion as they know more than we. Not only is knowledge power, but it is KING. It is the philosopher's stone to us, and we must possess it or perish. Everywhere and in every way therefore, we must try to enlarge the circle of our knowledge; knowledge of methods of farming, of fertilization, of markets and measures, and of the demands of the times. We must seek this improvement by clubs, libraries, newspapers, books, discussions, good schools for our children, an efficient agricultural college, if that is possible, and, not least, by the construction and distribution of valuable reports from this Board.

#### POLITICS.

Much as we shrink from dabbling in the dirty pool of politics, we must do it in our own quiet determined way until we have done our part to throw out the impure elements. It is imperatively necessary for us, of all parties, to rise above the corruptions of the day; to demand a purer ballot-box, a juster sense of the people's rights, and a displacement of all corrupt men in offices of trust.

We want to be left free to pursue our quiet and honest industry without distress from exorbitant taxes imposed by the extravagance of selfish politicians. We must insist upon the reduction of central power; upon a purer and simple democracy of the people, upon less government from above and more order below; upon all unjust discrimination, and the closest approach to an equal participation in the profits of all trade and industry. Until we secure these benefits we are bound.

#### OUR DUTY.

As a State Board of Agriculture we must rise to a higher plane of thought and action. We must do more to be a felt power in this great State. I heartily second the recommendations which our Secretary will make for our greater efficiency, and the suggestions of our Entomologist, and I trust, gentlemen of the Board, that we shall enjoy a profitable meeting, and return to our homes with strong purposes for another year of effective work.

## IN CONCLUSION,

permit me to refer to one or two points closely related to the farmers' interests and permanent growth.

Our professional neighbors are not quite as sensitive to the changes of the times as they might be. The family physician whose services are occasionally of vital importance to our home interests appears to be slow to appreciate the occasional depressed ability of the farming community, and charges the same for his services, whether wheat is fifty cents or one dollar a bushel.

The same remark may be made of the lawyer. His fees bear up under the pressure of the times, with remarkable endurance, and pay no regard to the causes of distress which drive the farmer to the law. It has appeared to me that a gentle hint to these professions might not be out of place.

The other point to which I desired to make reference, is the duty of our rural population to their own perpetuity and strong growth. The uneasiness of young people to get rid of the quiet routine of life on the farm, and fly to the cities, is a growing evil. Many other causes, doubtless, lie behind this fact—but one only I will make prominent—the want of attractions at home. As farmers, we must pay more attention to the natural desires of our children. They, as well as ourselves, are susceptible to the charms of cultivated beauty. Let us, in our humble and inexpensive way, give to our homes an air of neatness and beauty. Young people cannot bear the strain of "all work," they must have "some play." Let us furnish them healthful and rational amusements.

Let us provide our families with profitable and interesting reading. At all events we should encourage our farmers to take the agricultural papers of our own State. In some such manner we may confidently expect to relieve the embarrassment referred to.

On motion of Mr. Brown, the President's address was referred to a committee consisting of Messrs. Brown, Tilden, Stark, McCullough and Hall.

The Secretary presented the following report:

OFFICE OF THE STATE BOARD OF AGRICULTURE, }  
St. Louis, December 6, 1876. }

*To the President and Members of the State Board of Agriculture:*

I have the honor to submit a statement of the warrants issued by the Executive Committee on the Treasurer, from February, 1876, to December, 1876:

DATE.	TO WHOM ISSUED.	NO.	AMOUNT.
February 29...	John Monteith, expenses of office.....	62	\$31 35
29...	" " salary for February.....	63	150 00
29...	C. V. Riley, salary for February.....	64	250 00
March 8...	Theo. Pergaude, Janitor, salary for February.....	65	15 00
31...	C. V. Riley, salary for March.....	66	250 00
31...	John Monteith, salary for March.....	67	150 00
31...	Barton Able & Co., rent for two months.....	68	83 80
31...	John Monteith, expenses of office.....	69	86 40
April 29...	C. V. Riley, salary for April.....	70	250 00
29...	Barton Able & Co., rent.....	71	41 66
29...	John Monteith, salary for April.....	72	150 00
29...	" " expenses of office.....	73	31 65
May 22...	D. Jonnopoulo & Co., care of awnings.....	74	8 00
31...	C. V. Riley, salary for May.....	75	250 00

## STATEMENT—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	AMOUNT.
May	81... John Monteith, salary for May.....	76	\$150 00
	81... " " expenses of office.....	77	38 80
June	3... E. G. Obear, rent for May .....	78	41 65
	80... C. V. Riley, salary for June.....	79	250 00
	30... John Monteith, expenses of office.....	80	54 90
	30... " " salary for June.....	81	150 00
	30... E. G. Obear, rent.....	82	41 65
July	31... C. V. Riley, salary for July.....	83	250 00
	31... E. G. Obear, rent.....	84	41 65
	81... John Monteith, salary.....	85	150 00
	31... " " expenses of office.....	86	40 10
August	15... " " expenses of Dr. Detmers.....	87	50 00
	31... " " expenses of office.....	88	87 55
	31... " " salary for August.....	89	150 00
Sept.	1... E. G. Obear, rent.....	90	41 65
	5... H. J. Detmers, services for investigating hog cholera	91	150 00
	5... John Monteith, expenses of Dr. Detmers.....	92	60 30
	20... C. V. Riley, salary for August.....	93	250 00
	20... John Monteith, expenses of office.....	94	35 80
	30... E. G. Obear, rent.....	95	41 65
	30... C. V. Riley, salary for September.....	96	250 00
	30... John Monteith, salary for September.....	97	150 00
	80... " " expenses of office.....	98	46 85
October	18... C. V. Riley, carpet for office.....	99	70 55
	80... John Monteith, salary.....	100	150 00
	30... " " expenses of office.....	101	40 00
Nov.	1... E. G. Obear, rent.....	102	41 65
	1... C. V. Riley, salary.....	103	250 00
Dec.	1... E. G. Obear, rent and gas bill.....	104	42 65
	1... C. V. Riley, salary.....	105	250 00
	1... John Monteith, expenses of office.....	106	23 25
	1... " " salary .....	107	150 00
Total.....			\$5,187 01

It will be seen from the foregoing statement that the expenses of the Board for ten months have been \$2,687.01. The remaining two months will require \$458.30, which will make a total expense for the year ending February 1, 1877, of \$3,140.31.

## WORK OF THE YEAR.

At the last meeting of the Board, several important duties were devolved upon committees; the most interesting of these was the visitation of the State University and the investigation of the hog cholera. The committee to visit the University were entrusted with an examination into the condition of the

## AGRICULTURAL SCHOOL.

A report by this committee is embraced in the Eleventh Annual Report, and needs no further reference here. We have assurances that Dr. S. S. Laws, the newly inaugurated President of the University, and Prof. G. C. Swallow, the Director of the Agricultural Department, will be present at this meeting, and present to you the facts regarding the actual condition of this institution, and open to you the prospects of its future growth and usefulness.

## REPORT ON THE HOG-CHOLERA.

A committee including some members of this Board, and the professors of the Agricultural School, together with other distinguished gentlemen, was appointed to secure information respecting the greatest scourge of the western farmer—the so-called hog-cholera. That committee met and organized at Columbia, but nothing was done towards developing its work until February, apparently for the reason that the official members of the committee were outside the membership of the Board, and therefore lacked the necessary means for commencing the work. As soon as I entered upon the duties of Secretary in February last, I issued several thousand copies of a circular prepared by Prof. P. Schweitzer, proposing questions to be answered by hog-raisers, and distributed in different parts of the State some two thousand copies. The replies to these questions were sent to Prof. Schweitzer, and he afterwards forwarded those replies to this office. The resolution of the Board contemplated the rendering of a report by this committee in ninety days, and placed the amount expended for the investigation with the judgment of the executive committee, making the available means of the Board the limit of expenditure. The circulars and their replies elicited much valuable information, but really furnished no substance suitable for a useful report.

Regarding the committee as virtually discharged by limitation, the executive committee considered it their duty to pursue the subject and employ the proper skill to effect a thorough investigation.

After some correspondence with veterinary physicians, an arrangement was effected with Dr. H. J. Detmers, of Kansas, to come into the State and begin an autopsy as soon as the disease re-appeared. This event did not happen to any considerable extent until August. At that time the epizootic disease prevailed to an alarming extent in Jackson and several other counties of the State. After consulting with our member, Mr. D. L. Hall, of Kansas City, Dr. Detmers was sent for and commenced a vigorous examination of diseased subjects in Jackson county. Both Mr. Hall and many farmers of the county rendered valuable aid to the work in that section.

From Jackson Dr. Detmers proceeded to Lafayette, and was received and aided by another member of the Board, Hon. M. V. L. McClelland.

From thence he proceeded to St. Charles, where he was counseled by Mr. Geo. W. Kinney, who, unfortunately was too ill to accompany the doctor in his investigations. At Kansas City Dr. Detmers was joined by Prof. Schweitzer, who made examinations with his microscope and gathered material for chemical analysis at his laboratory. Prof. Schweitzer informs me that he has not yet finished his analysis, but hopes to work out something that will be of value to insert in the 12th report. Dr. Detmers' work has already been given to the public. Several hundred copies of his report published in full by the *St. Louis Globe-Democrat*, were sent from this office, and the demand for them in our neighboring States has not yet ceased.

## VALUE OF THE REPORT.

A careful observation of the influence of Dr. Detmer's report has convinced me that it is worth many times what it cost. The main point of its value consists in the establishment of facts, which are proven to be so widely characteristic of the hog malady, as to constitute a most satisfactory induction regarding the main features and principal causes of the disease.

Dr. Detmers has proved that what has been supposed to be cholera is *not* cholera. This important discovery must lead to a very different mode of treatment from that which has hitherto prevailed; and the fact that the disease is of the general nature of an influenza, must influence farmers to a stricter care respecting the exposure of swine-

#### CRITICISMS OF THE REPORT.

It was to be expected that criticism, both favorable and adverse, would be elicited by Dr. Detmer's conclusions. Some subsequent examinations of a limited character disclosed the presence of worms in the affected animals, and straightway the conclusion was caught that Dr. Detmers was all wrong in his theory of influenza, and worms are the cause of all this trouble among swine. These parasites were discovered by Dr. Detmers in several subjects coming under his knife and microscope, but their presence did not indicate that they were the cause, but rather that they were one of the results of the disease.

Many have been disposed to ridicule the position taken in the report, that the hog requires a cleanly care, or that the animal is naturally disposed to be clean when an opportunity is afforded. It has even been triumphantly asserted that particular herds of swine have constantly waded in filth and yet have not been affected with the disease. On the contrary, herds have been referred to whose condition was all that could be desired in the direction of care and cleanliness, and yet the epizootic has made fearful havoc among them. The generalizations, made from such cases are very faulty and mischievous. They proceed from the want of a clear distinction between general and exciting causes. The general cause of the influenza of swine is without doubt atmospheric and hidden from the eye of science.

Dr. Detmers' report is, perhaps defective in not giving more prominence to this fact. The exciting causes are in the exposure, checking of the perspiration, filth, improper food, etc., which particular swine or herds experience. Now is it not difficult to understand that in some instances the general cause may be so intense as to produce the disease even without any of the exciting causes named, or again the general cause may be so far absent from particular localities that the worst of the exciting causes in these localities may fail to produce the disease. One of these

#### EXCEPTIONAL CASES

came under my observation, of a remarkable character. Capt. Zelgler of Pevely, has kept during the summer and autumn 116 head of hogs. These animals were herded on high ground upon a clover field and were treated to pure spring water.

Special pains were taken to prevent disease. The herd received several washings with soap, were not lousy, slept in small parcels, received a variety of food, consisting of corn, oats, boiled potatoes, etc. Large quantities of charcoal were furnished them, and occasional doses of salt and copperas. Twenty-eight were more closely confined in clean quarters, and the balance had the run of woods and acorns. The breed was Berkshire and Poland China, with a few thoroughbred Berkshires. Of the one hundred and sixteen one hundred and thirteen died within a few weeks. The first to go were the thoroughbred Berkshires, and the strongest survivor was a native sub-soiler.

This evidently was one of those exceptional cases in which the remote or general cause overcomes all efforts to prevent or remove the exciting causes.

I firmly believe that the diagnosis of Dr. Detmers is correct. His theory of the causes is true. But a clearer distinction should undoubtedly be set up by which these causes should be known as exciting causes; while the real or remote cause unquestionably remains in the atmospheric influences, and still baffles science and calls for inves-



tigation. I think it is the duty of this Board and of all Boards of Agriculture, to take such action as shall lead the General Government to grapple with this scourge, disclose its hidden cause and point out its remedy. So far as it has gone, this Board has without doubt done more to compass this object than any similar body. The report of Dr. Detmers is excellent, and will effect much practical good. But the amount of loss to western farmers is simply stupendous. With our imperfect means of gathering statistics, estimates are unsatisfactory. If, however, the reports already received from competent judges in different counties is a fair index of the whole, the loss to the State of Missouri, during the past year, will not fall far short of \$2,000,000. I would suggest that it would be proper for this Board to request the Governor to bring this subject before the General Assembly, and urge that body to memorialize Congress in its behalf.

#### THE ANNUAL REPORT.

With the proceedings of this Board the matter of the 12th Annual Report will go directly to the State Printers. Excepting the reports from counties, the chief portion of the Report will be laid before the Board. Fortunately, the time of the annual meeting of the State Horticultural Society has been changed from February to December, and there is good reason to hope that the printing of the Report will be finished at the opening of the new Legislature. This is a much needed reform. For several years past the Report has been nearly a year old when it came to the farmers, and so far as it sought to be a medium of communication with the Legislature it amounted to nothing.

One other reform is urgently demanded. The effort to secure voluntary reports from the counties is rewarded with very indifferent success. What our farmers need to guide the formation of intelligent plans is knowledge of what their neighbors and the rest of the country are raising. To furnish them with these facts it is absolutely necessary that the law relating to the duties of county assessors should be so amended as to require these officers to make periodical reports upon blanks prescribed by the Board of Agriculture.

I would respectfully urge that the Board take some action looking to this reform.

#### THE WORK OF THE BOARD.

That the State Board of Agriculture ought to effect more for the development of the State and the good of her farmers, I am sure we, who have been members for several years past, have deeply felt. Just how to accomplish this good has been a subject of much study with me. Permit me therefore to suggest some practicable lines of effort. Take the main crops, for example—wheat, corn, oats, hay, rye, broom corn, flax and castor beans, together with the staple classes of live stock, horses, cattle, mules, swine and sheep (add also the butter and cheese dairy). Now let each member of this Board be a committee of one to report on one or two of these subjects. Let him build up the matter of his report by conducting experiments on a small scale—for instance upon wheat—its mode of culture, time of seeding, variety of seed, etc.; and let these reports be brought to the annual meetings, with specimens of products and seeds; and if, after due testing and examination, the Board shall place confidence in any variety of seed or any particular mode of culture let the facts and the seeds, if they can be obtained, be distributed. In this way the Board of Agriculture may establish a dozen experimental farms, in different portions of the State, and be the means of leading our farming industry into more progressive paths.

Another reform is suggested in the poverty of the

# AGRICULTURAL ROOMS.

By small and gradual increments of growth there ought to be collected here a museum of Agriculture for the State of Missouri. First of all, as a fair division of the funds will admit, there should be a gradual building of a first class agricultural and horticultural library, containing the reports of the other States, the standard books on the different specialties of agriculture, bound copies of the leading agricultural papers and the herd books of thoroughbred animals.

Next to this, by a small amount of vigilance and industry on the part of the Secretary and the members, an herbarium, representing the flora of the State may be gathered. A small expenditure from time to time in taxidermy will give us a collection of at least the useful and harmful birds of the State. A little emulation may be incited among the counties to send in specimens of their representative forest timber, and specimens of annual crops. Add to this the representative seeds of the State. These together with the magnificent collections of the State Entomologist, would draw together the great State of Missouri into

## A NUT SHELL,

and proclaim to the world that we have the highest grade of knowledge—that we know ourselves. As an auxiliary in this direction I take pleasure in acknowledging the courtesies of many of the agricultural and horticultural periodicals of the country in exchange for our Reports.

We have on file in these rooms as the fruit of these courtesies : The Country Gentleman, The American Agriculturist, The New England Farmer, The Florida Agriculturist, The Southern Rural, The California Farmer, The Sacramento Farmer, The Prairie Farmer, The Indiana Farmer, The Ohio Farmer, The Michigan Farmer, The Scientific Farmer, The Fruit Recorder, Gardeners' Monthly, Poultry Record, Bee Magazine, Live Stock Journal, Poultry Nation, and not least The Rural World and Journal of Agriculture.

The report of the Secretary, on motion of Mr. Tilden, was referred to Messrs. Tilden, Colman and McCullough, committee.

Col. Colman thought special attention should be called to that portion of the report referring to an agricultural museum. He said he had visited such a museum of the Department of Agriculture at Albany, and found it filled with the representative products of the different counties of the State. He referred also to the excellence of the same feature in the Ohio Department of Agriculture, and hoped, if the means of the Board would permit, some special attention would be given to the subject.

Prof. Riley testified to the usefulness of such a feature, but thought a permanent home for the Board was indispensable to its success.

The Treasurer's report was read by W. T. Essex, Esq. :

**WM. T. ESSEX, TREASURER, IN ACCOUNT WITH STATE BOARD OF  
AGRICULTURE, DR.**

1875.				
Dec.	2.....	To balance.....		\$1,075 94
1876.				
Jan.	12.....	Auditor's warrant.....		1,000 00
Feb.	29.....	" ".....		1,000 00
March	31.....	" ".....		3,000 00
June	15.....	" ".....		1,000 00
Sept.	28.....	" ".....		1,000 00
1875.			Voucher	
Dec.	1.....	By C. V. Riley.....	50	\$250 00
	22.....	R. A. Campbell.....	29	250 00
	2.....	Expense of members.....	67	243 90
1876.				
Jan.	1.....	C. V. Riley.....	53	250 00
		G. W. Kinney, expense to Columbia.	55	21 70
		John Monteith, " "	52	20 99
		Walbridge, Holland & Brown.....	54	110 00
		Jno. S. Marmaduke.....	51	150 00
		Jno. S. Marmaduke.....	56	150 00
		Henry T. Mudd.....	30	43 00
		Jno. S. Marmaduke.....	58	150 00
March	1.....	Expense account.....	62	31 35
		John Monteith.....	63	150 00
		C. V. Riley.....	59	250 00
	3.....	C. V. Riley.....	64	250 00
	1.....	Wm. T. Essex, discount.....	61	261 11
	8.....	Theo. Pegande, expense.....	65	15 00
	13.....	Expense account to Jno. S. M.....	60	314 20
	31.....	C. V. Riley.....	66	250 00
		John Monteith.....	67	150 00
		Expense account.....	69	36 40
April	29.....	John Monteith.....	72	150 00
		Expense account.....	73	31 65
May	1.....	Rent of office April, 1876.....	31	41 65
		" Feb. and March, '76....	63	83 30
		" April, 1876.....	71	41 66
		C. V. Riley.....	70	250 00
	31.....	John Monteith.....	76	150 00
		C. V. Riley.....	75	250 00
		Expense of office.....	77	38 80
June	3.....	Rent.....	78	41 65
		D. Janapolo & Co., expense.....	74	8 00
	30.....	John Monteith.....	81	150 00
		Expense.....	80	54 90
		C. V. Riley.....	79	250 00
		Rent.....	82	41 65
July	31.....	John Monteith.....	85	150 00
		Expense.....	86	40 10
		C. V. Riley.....	83	250 00
		Rent.....	84	41 65
Aug.	31. ...	Hog cholera expense.....	87	50 00
		Expense.....	88	37 55
		John Monteith.....	89	150 00
Sept.	1.....	Rent.....	90	41 65
	15.....	Hog cholera expense.....	92	60 30
	20.....	Expense in office.....	94	35 30
		C. V. Riley.....	93	250 00
		H. J. Detmers.....	91	150 00
Oct.	2.....	John Monteith.....	97	150 00
		Expense.....	98	46 35

## TREASURER'S REPORT—CONTINUED.

	1876.	Voucher		
Oct.	2.....	By C. V. Riley.....	96	\$250 00
		Rent.....	95	41 65
	30.....	John Monteith.....	100	150 00
		Expense.....	101	40 00
Nov.	1.....	Rent.....	102	41 65
	13.....	Whedon, Tyler & Co., expense.....	99	70 55
	17.....	C. V. Riley.....	103	250 00
Dec.	5.....	Balance on hand.....		848 18
				<u>\$8,075 94</u>
			\$8,075 94	
Dec.	5.....	To balance brought down.....		\$848 18

Of the above balance, \$750 belongs to the C. V. Riley fund. From December 1, 1875, to the present time, I have paid discount on Auditor's warrants, \$312.20. None of the warrants issued to me this year, (excepting one of \$1,000, January 12, 1876) have been paid, and, I suppose, will not be until about the middle of January next. I would respectfully ask the Board to allow the accompanying bill for discounts, or refer it to the Committee on Finance.

## CONDENSED STATEMENT, DECEMBER 6, 1876.

C. V. Riley, December 1, 1875, to November 30, 1876.....	\$3,000 00
Traveling expenses.....	329 59
Expense account:	
Maps for Report.....	\$250 00
Short-hand reporter.....	110 00
	360 00
Expense of office, including rent.....	1,477 77
Expense account attending hog cholera examination.....	260 80
Jno. S. Marimaduke, salary, November, '75, December, '75, January, '76.....	\$450 00
Jno. Monteith, salary.....	1,850 00
	1,800 00
	<u>\$7,227 66</u>

Respectfully submitted,

W. T. ESSEX, Treasurer.

The report of the Treasurer was accepted and referred to a committee consisting of Messrs. Hall, Tilden and Shannon.

Prof. Riley, State Entomologist, sketched the outline of his next Report. [As the Report itself will follow these proceedings, the outline is not necessary here.]

On motion, the Board adjourned to meet to-morrow at 9 o'clock.

## SECOND DAY.

The Board met pursuant to adjournment.

The reading of the minutes of preceding day was dispensed with.

The committee on the Treasurer's Report submitted the following :

MR. PRESIDENT : Your committee, to whom was referred the report of the Treasurer, W. T. Essex, Esq., beg leave to say that they have examined the statement of the Treasurer together with the vouchers of the Secretary, and find the same correct.

We also find that, in order to secure funds to meet the expenses of the Board, the Treasurer has been compelled to discount several of the State Warrants. We recommend that he be reimbursed from the treasury to the amount of the discount.

Respectfully submitted,

D. L. HALL,  
JOSIAH TILDEN,  
R. D. SHANNON,  
Committee.

On motion of Mr. Brown, the report was accepted, the Executive Committee authorized to draw a warrant in favor of Mr. Essex for the amount of discount, and the committee discharged.

The committee, to whom was referred the report of the Secretary, made the following report :

MR. PRESIDENT : Your committee, to whom was referred the report of the Secretary, take pleasure in commending the report as containing several points of special interest to the Board. We would call particular attention to the reference of the report to the establishment of a museum, and to the necessity of such a change in the law as shall require county assessors to report statistics to this Board.

Respectfully submitted,

JOSIAH TILDEN,  
N. J. COLMAN,  
J. L. McCULLOUGH,  
Committee.

The regular order was taken up, being reports of members upon the condition of the crops.

Col. Colman reported for St. Louis county an average corn crop.

Mr. Brown, from the interior of the State, gave an unfavorable account of the crops. The weather at the time of sowing the last wheat crop made it difficult to secure a good stand, and the consequence was a low average. The net price of wheat had not exceeded 50 to 60 cents per bushel. On account of the extremely wet weather in the spring, the corn crop was unusually poor. The oat crop (fortunately, for it is the nursery of the chinch bug) was not extensively grown, and its yield was poor in quality and amount. The hog crop was somewhat diminished by the excessive shipment of hogs, on account of the short corn crop of the previous year, and was further

greatly reduced by the prevailing hog disease. Mr. Brown regarded with favor the fact that a considerable demand for the American pork produce is springing up in foreign countries.

Mr. Tilden reported from the southwest. Owing to sickness of farmers, a less breadth of wheat was sown than usual, but a good result obtained. Price 80 cents per bushel. The present wheat crop covered about three times the acreage of the former crop, but when the blade appeared, grasshoppers came and swept it away. Very late sown wheat may yield a fair crop, but the apprehensions respecting the return of the locusts are grave.

Oats an average crop. Corn about half a crop. Hog crop about as usual, with some depletion by disease.

Cattle not one-third of the amount of last year, by reason of the close shipments of the previous year.

Mining interests increasing. New developments of lead daily, giving promise of greatly increased wealth to that section.

Mr. Stark, of Louisiana, reported wheat as covering an average breadth, and quite above an average yield of fair quality. Corn about two-thirds of a crop. The wet season prevented good cultivation in certain locations. A remarkable exception to the ordinary notion had been demonstrated in the successful working of corn when the land was wet.

Oats looked fair until headed out, when rust diminished the yield to one-half the average. Hay crop an average, and well put up. Tobacco an average crop.

#### FRUITS.

Small fruits productive. Peaches about one-fifth a crop. Apples abundant, more so than for several years.

Mr. McCullough, of the northwest, reported a good, general condition. Corn and hogs are the staple. Corn excellent, and a very fair hog crop. Fruit crop fully to the average.

Cattle have done well, and the people of the northwest are improving their condition and are prosperous for the times. Counties are rapidly populating by immigration. Intelligence regarding improved machinery, increasing. No disturbances from grasshoppers.

Mr. Hall reported from the Kansas City district. The season generally prosperous. The wheat crop something above average. Corn 75 per cent. of average. The oat crop a failure, by reason of wet and rust. The majority of the crop not cut. Hay crop good.

Grasshoppers of the previous year entirely destroyed timothy and clover, but not blue grass. Tobacco much more than average. Barley not much raised. Rye good. Hog crop not more than twenty-five per cent. of average, on account of scarcity of corn and hog diseases. Cattle good. Sheep raising prosperous and increasing. Fruit one-tenth of a crop. Grapes more than average by twenty-five per cent. Mr. Hall finds a marked decrease of insects obnoxious to fruits, as a consequence of the grasshopper raid.

The following letter was read, and, on motion of Mr. Brown, ordered printed with the proceedings :

INDEPENDENCE, MO., December 1, 1876.

*D. L. Hall, Esq. :*

I have just returned home and find your letter of inquiry, and hasten to answer, as far as I can give you any satisfactory information. The general prospects as to

agriculture seem to be considerably improved to what they were two or three years past, and would have been much better if it had not been for the great loss among our swine.

Not having any census or statistical records at hand, it would be altogether random for me to speak of the average of grain in this county, but in my own neighborhood wheat ran from 10 to 25 bushels. Oats light from rust, and none of it threshed. Rye a fair crop, 20 to 40 bushels. Barley, none. Corn a good average crop, 35 to 60 bushels. Grasses cultivated, but little to mow since the destruction by the locust, but many fine meadows beautifully starting.

Prairie grass mostly broke out and destroyed in the county, which is a great pity and oversight, since the people are just waking up to the great value of the wild prairie grass, not only for summer grazing, but more especially for mowing for hay, which is now just becoming to be acknowledged to compete in good and nutritive qualities with our cultivated grasses, and is perpetual without the great cost of renewal as other meadows require. Our blue grass for fall and winter pasture is good this season, and is the best grass for grazing purposes, and it is a great pity that it is not more generally increased, especially in all our timbered districts.

We have had the disease among our hogs to an alarming extent, destroying in my neighborhood nine-tenths, and that, too, of many valuable herds of fine stock. After conversing with many of our most intelligent farmers, it seems to be pretty well settled among them that the disease was introduced by hogs shipped into various neighborhoods to follow cattle that were being fed on our great surplus of corn. These hogs were from Texas, and were diseased and dying when put off the cars, and continued to die by hundreds. Thence inoculated into all stock that were below on creeks or all farms where stock had access to roads, but not to stock cut off from exposure, or where no other animals were brought in. It was introduced into the human family by feeding milch cows in the same lot with hogs, and the cows eating the fodder containing the saliva from the hogs, and several deaths resulted in one family in the southern part of the county. The physicians pronounced it scrofulous pneumonia, but the neighbors who were familiar with the disease, are satisfied that it was nothing short of the hog malady. I am not alone in the opinion that this subject should be brought before our State Legislature, and I know of no better course than through our *Agricultural State Board*. Some of us had been thinking of bringing it by resolution before the next session of the Legislature. Yet it may be better to come up through your Board. It is doubtless a disease introduced from the S. W. (Texas,) after the character of the cattle disease from the same source, which in years past has had such disastrous effects upon the cattle of the Western States, and which claimed the serious attention of stock growers and State Legislatures. A stop should be put to the shipment of hogs from that source into our rural districts. If it is not done by the proper authorities of law, the people will, as they have done with the cattle, use their guns on the line where herds have encroached, and broke up many of our farmers who have suffered repeated disaster from that source.

We had no pears, and but few peaches and apples, except some orchards that did not suffer as bad as others by the locusts.

Grapes one-third to one-half crop; fruit good where there was bearing wood. Young vineyards as young planted trees were mostly destroyed, and most fruit that was matured, was on old well established vines and trees. We had a good half crop of cherries on E. May, and some on Gov. Wood, and a few other kinds. Pretty fair crop of blackberries and raspberries, but few strawberries. Pretty fair crop of sweet and Irish potatoes.

Very respectfully,

Z. S. RAGAN.

P. S.—I have noticed that our Horticultural Societies are invited to send a delegate to your meeting on the 6th. I will bring it before them, but doubt whether any one can be got to go, and trust you can represent our interests at that time, and hope you may have an interesting and profitable meeting of the Board.

Z. S. R.

J. S. Rollins: Having traveled over a large portion of the interior about Boone county, found the wheat crop poor. Corn one-half crop. Oats a failure. Hog crop short on account of the moving out of swine the previous year by reason of scarcity of corn and hog-cholera. Cattle rather scarce. Hay crop good, gathered with some difficulty, and prices so low as to pay little or no profit from shipping.

Maj. Rollins paid a fine tribute to the model farm of Rocheport, which received some years since a premium as the best farm in the State.

Prof. Swallow, remarked upon the plowing of corn when the ground is wet. The experience of the past wet season shows good success when the ground would admit of the passage of teams. Some however, had found it otherwise.

Mr. Brown confirmed the observations of Prof. Swallow, and added that Howard county has a fine tobacco crop.

Mr. Charles, from Southeast Missouri, stated that corn and wheat are the principal crops of his portion of the State. Farmers on the river bottoms have almost entirely lost their crops from floods. The lower and river counties fared not so badly. Early planting did best, because the corn was large enough to stand the excessive wet.

Wheat crop in Jefferson county, one-half the ordinary crop. Barley scarcely grown. Rye light. Fruit crop a failure, except winter apples. As to the hog crop, everything was unusually promising, on account of the large amount of mast, but the appearance of the hog-disease reduced the number of hogs about sixty per cent.

The President, Mr. Harris, vacated the chair, to give his experience in cultivation of the ground when it is wet. If rain does not follow land plowed in this condition, injury is surely done. The soil seems to be killed or deprived of its vitality. In his portion of the State the wheat crop is very uncertain, succeeding not more than once in three years.

Mr. Brown, in the chair, asked if the region reported by the speaker had not formerly been known as a good wheat region.

Mr. Harris replied that such was the fact, but that the yield for several years past had deteriorated.

Upon oats, Mr. Harris reported unfavorably; they are exhaustive and injurious to grass seeding. Rye was commended as a certain crop, affording good fall and spring feeding, and the shelled crop brings 75 cents a bushel, and pays better than wheat.

Mr. Stark asked in regard to the preparation of land for wheat.

Mr. Harris replied that the land was usually twice and thoroughly plowed; the first plowing is shallow, the second deeper. The roller follows the drill. Rye ground, and mixed with other grain, is used for feed for all descriptions of stock.

Col. Colman remarked that as a teacher of farmers for twenty-five years, he had always opposed working land when wet. He had known land to feel the effects of such treatment for years. Still, he had found, by observation and experience, that plowing corn in the wet had succeeded; this even in clay soil. You must be sure to have rain follow it, unless you want to ruin your land. He had been astonished to learn that corn crops had been saved and a large yield gathered when the horses attached to the plow had sunk in to their knees in plowing the land, but experience taught him it was true. He said the matter of winter pasturage was a subject of vital importance to the farmer. He had sowed rye in his corn, broadcast, and it made fine pasturage for his



hogs. Besides, it was an excellent fertilizer of the soil. In Tennessee and Kentucky they let the stock take care of themselves in winter. There they could feed on the blue grass all winter. Here, where it is needed, winter pasturage is sadly needed, and is as sadly neglected by a majority of the farmers.

Mr. Stark came back to the subject of wet plowing, and remarked that while he was opposed to the practice in general, yet in a wet season it is better to kill the weeds rather than let them kill the crop. He plows successively deeper and deeper, and this obviates the difficulties of wet plowing.

Mr. Brown thought most farms too small to promote winter pasturing, but no farm is so small but that it may contain two or three acres of winter rye. Mr. Brown hoped the impression would go out that this Board insists on rye pasturage.

Mr. Hall, in answer to a question about the effect of green rye on milk and butter, stated that the rye produced no strong flavor in butter.

Mr. Charles confirmed this view.

Major Rollins inquired about the relative value of prairie and tame grass.

Mr. McCullough, being called on to respond to this question—coming from a prairie country—stated generally that prairie grass was very valuable for feed. It was not so good, weight for weight, as blue grass or timothy, but, considering the difference in cost, it was much cheaper food. It was much better than Hungarian grass, because there was no danger of it making a horse founder, while the robin weed, which is found so plentifully among prairie grass, has very beneficial effects on horses afflicted with the heaves.

Prof. Swallow, upon the question of prairie and tame grasses, stated that he had made investigations among the Government agents from Arkansas to British possessions. The testimony of these men was that they paid the same price for wild as for tame hay. In some localities they paid more.

Col. Colman, in answer to a question as to whether good butter can be made from prairie grass, claimed that good butter can be made from any grass and any soil. He further stated that he had been accustomed to urge his readers to cut and cure and bale prairie grass for the St. Louis market.

As to the dairy question, Mr. Tilden confirmed the views expressed regarding the value of prairie grass, but thought it could not be depended upon as permanent. The grazing of it will eventually stamp it out. For early and late feeding prairie grass is not good. Its nutritive power is confined to the summer months—say four months in the year.

The President gave as the result of fifty years' observation, that prairie grass exceeds all other, for nutrition, from about the 1st of May to the 1st of October. He, however, claimed the short life of the wild grass, and thought that blue grass, first and last, should be sown on the raw land. It will spread for miles and covers the otherwise naked spaces left by the disappearance of the wild grass.

On motion of Major Rollins, the regular order was so far suspended as to fix the subject of the Agricultural College for this afternoon at 2 o'clock.

On motion of Col. Colman, the Board adjourned to meet at 2 o'clock p. m.

## AFTERNOON SESSION.

The Board met pursuant to adjournment.

The committee on President's address reported as follows.

## REPORT OF COMMITTEE.

**MR. PRESIDENT:** Your committee, to whom the President's Address was referred, respectfully report that they highly commend and indorse the sentiments of the address and the happy manner in which those sentiments were uttered.

We find in the address no special recommendation calling for resolution, but we take especial pleasure in giving emphasis to that part of the address which recommends the increased attractiveness of farmers' homes as a means of retaining their children in the noble work of bringing the agriculture of our State up to that plane so earnestly demanded at our hands.

Respectfully submitted,

L. A. BROWN,  
D. L. HALL,  
JOSIAH TILDEN,  
WM. STARK,  
J. L. McCULLOUGH.

On motion of Mr. McCullough, the report was accepted and committee discharged.

The regular order was taken up, which was the Agricultural College, and opened with an address by Hon. R. D. Shannon, State Superintendent of Public Schools. Dr. Shannon's paper was a brief, practical discussion of the present condition of the State Agricultural College, and contained several valuable hints as to the course necessitated for the improvement of this particular institution. He suggested the propriety of establishing farms in different parts of the State, to be cultivated and improved by the agricultural students. He submitted that in this way alone could the requisite acquaintance with the different varieties of soil be gained, since the farm at Columbia by no means combined the varieties to be met with in the large State of Missouri.

Dr. Law's address was a scholarly elucidation of the theory that education makes the man—that is to say, proper education. He said that the agricultural classes had never been recognized as a prominent element or rather a controlling element in any nationality from the earliest history up to the present time. He imputed this to the fact that the agricultural classes were uneducated. The speaker showed the necessity of education. Then coming directly to the point in question, made an elaborate statement of the growth of agricultural education in this country, and concluded his exhaustive address by defining the necessities of the State Agricultural College. He called attention to the last report of the State Board, in which he considered great injustice had been done to the Agricultural College. He read the part of the report complained of, and then gave a lengthy disquisition on the objects of the college and its methods of management, concluding with a brief sketch of the career of Prof. Swallow, the Dean of Faculty of the college. As a preface to this sketch, Dr. Laws stated that there was no man on the face of the earth for whom the State of Missouri could afford to swap Prof. Swallow.

Maj. J. S. Rollins of Columbia, then took the floor, and entered upon an elaborate argument in defense of the management of the college, and urged repeatedly the vital advantage of the institution to the interests of the State.

On motion of Prof. Swallow, the report of the Committee on Agricultural College was referred back to the committee of last year appointed to visit the University. Messrs. Brown and McCullough were added to said committee.

On motion, the Board adjourned to 8 o'clock this evening.

## NIGHT SESSION.

The Board met according to adjournment.

Pursuing the regular order, Prof. Swallow occupied the floor.

[The substance of the remarks made by President Laws, Prof. Swallow and Major Rollins will be found in communications in the sequel of this report.]

Prof. Riley, the State Entomologist, said that he had listened with the greatest pleasure to the remarks of the President of the University. It was a relief to know that we had now at the head of that Institution, one who had such broad and comprehensive views of education. He feared, however, that Prest. Laws yet failed to fully appreciate the needs of the Agricultural Department, and his high praise of its past working and declaration that the plans on which it was being carried on were perfect, gave little encouragement to those who believed that there was room for improvement, and had hoped that with a change of *regime*, a change for the better would occur. He (Prof. Riley) dissented from the idea that the lad who desired to become a first class farmer needed the broadest and most liberal education. Life is too short for a man to learn everything, and the agricultural student needs no more to waste his time in the study of *belles lettres*, law, medicine, metaphysics, psychology, the higher mathematics, etc., than the special students in those departments need to waste theirs in agricultural chemistry, vegetable physiology, animal physiology and economy, geology, botany, entomology, arboriculture, horticulture, veterinary science, dairying, animal and vegetable pathology, and the many sub-branches that these imply—all essential to the intelligent husbandman, and sufficient, with a general knowledge of some of the more useful studies taught in the public schools, to make him a man of liberal education. We want no more "Admirable Crichtons." In these days of specialties when men succeed only by division of labor and division of study, those who spread themselves out too widely succeed in covering nothing and are the most impractical and the least successful. The agricultural student needs special education, and there is no denying the fact that there is a strong feeling among those who are most deeply interested, that he has hitherto failed to get it at Columbia—that in short the Agricultural Department has been a failure. The experiments related by Prof. Swallow, and the present status of the farm and of the agricultural class, bear out this view. Few deny Prof. Swallow's ability, but if he had ten times the ability shown in the brilliant record presented to us by Prest. Laws, he would yet be incapable, single-handed, to run an agricultural college, and no one pretends that any of the other members of the Faculty teach more than would be required of them in any ordinary university, without an agricultural college appended.

It was, as has been remarked, easy to criticize and find fault, and no one was better aware of the fact. While the fault had existed, and was so prominent as to thrust itself upon us and not need the finding, all criticism had been disarmed in the past by the fact that there was a lack of means to carry out the plans. He did not intend to discuss the complicated question as to whether the Agricultural Department has received its due share of appropriated funds. The fact remains that the Institution is

now in need of means, and with the assurance which we have that the Agricultural Department will be pushed forward, if they are obtained, it is the duty of every good citizen who has the welfare of the State at heart, and who desires to see its educational institutions properly supported, to aid Prest. Laws, in every way possible, to successfully carry out his projects.

Two other positions taken by Prest. Laws he thought untenable, and would protest against. First: That any one who criticises the Agricultural College as it is and has been, must needs be inimical thereto; Second: That the background of the Committee's report was the idea of separation of the Agricultural College from the University.

If the faults and failings of an Institution are never pointed out they will never be remedied, and he believed that those who had criticised the past management of the college, were its truest friends. And as to the matter of separation, while with Mr. Kinney and others he had, when the matter was under discussion, been in favor of the establishment of a separate college, yet after the law was passed all the friends of progressive agriculture, including those who had favored separation, accepted the logic of events, and he did not believe there was a single member of the Board at this day in favor of any change, or that Mr. Kinney in expressing the opinion that matters would now look more encouraging if the separationists had succeeded, intended the construction Prest. Laws has placed upon it.

Finally, the committee report was made by men eminently capable, and who had no other object but to get at the truth. His own experience and observation at Columbia satisfied him that the report was moderate and just, and he only hoped, that with the present management, and by securing increased means from the Legislature, there would be no cause for any such report in the future.

The Secretary then rose to the question and said:

He was gratified that the President and the Director of the Agricultural College had taken the pains to be present at this meeting of the Board. He was glad that there was so deep an interest taken in the subject. The intensity of feeling was alike on both sides of this question. The only difference was in the class of feelings aroused. These gentlemen are sorry that we made so plain and caustic a report, and we are glad. That appears to be the main difference in the feeling it has awakened. There were but two or three points in the lengthy addresses of President Laws and Prof. Swallow, to which he felt it necessary to respond. Dr. Laws quoted from the report made by Mr. Kinney and myself, the statement then made that in our visit to the University "a distinctive agricultural school was not to be found," and met this statement with a flat and unqualified denial. Now, I have one short argument with which to refute this unsupported denial of the President, and that is to reaffirm, as I do unqualifiedly reaffirm the statement.

This I regard as a complete answer to the President on this point. We went to Columbia not altogether unqualified for our mission. It has been intimated that we gathered mere hearsay or gossip. This is wholly untrue. One of us had been a Curator of the institution for several years, and the other had, as Superintendent of Public Instruction, paid several visits to the University to learn the facts respecting its various departments. Our examination was made among the Curators, the President, the Professors and the Students. From the best testimony we could gather, we could only report that there was no distinctive Agricultural School. If there is one now, we shall only be too glad, for it is for the existence of such a school that this Board has always exerted itself.

The report unquestionably has done good, for the management of the agricultural department has never been so deeply stirred as now. Upon one point we take issue

with these gentlemen, as we have ever done. We believe the Agricultural College should devote itself to the speciality of agriculture, and not scatter its efforts over the whole varied field of language, mathematics and literature. We do not believe as these gentlemen profess to believe, that because it is desirable that a farmer's son should know Latin, on this account the Agricultural College should teach the ancient classics. We believe that the higher mathematics have no business in such a school. This whole thing of an Agricultural College is a mockery, if it is simply to tread over the old ground of the traditional college or academy. What we believe, and what we demand is that the agricultural school shall teach first and last, the science of agriculture, with such practical applications as may be embodied in useful experiments. We understand the vagueness of the act establishing this department. It is hard to give it an interpretation which will not include the whole range of human knowledge; for all knowledge is distantly "related." We complain that under this vague covering the endowment that was intended for an agricultural speciality has been devoted to the general purposes of the University. If this course has not violated a vague statute, it has violated the united thought and demand of our farming population. On behalf of this Board, I undertake to repel the insinuation made by the President, that because we have passed unfavorable criticism upon the Agricultural College, we are therefore hostile to it. On the other hand, it is our deep interest in the purposes and objects of such a school that has provoked this criticism. We are not quite sure that the intense emotion excited in the bosoms of the gentlemen representing the University is not an indication that our criticism is just. Why has the President found it necessary to eulogize the Professor of Agriculture? The Board has never attacked him. He has always been spoken well of in our meetings. To tell us of his glorious achievements in the past does not settle the points in our criticism. Past glory will never excuse present inefficiency. Indeed this educational pedigree is unfortunate, for it will only have the tendency to convince people that they ought to have expected more instead of less. No! we have thought the hands of Prof. Swallow were tied. Being called upon to administer to so many other branches of instruction or departments in the University, how could he make the agricultural school efficient and prosperous? We have criticised the act of the legislature. We honor the motives of Major Rollins, as seen in this legislation; and the State will always be largely in his debt for the struggles he has carried through to success in behalf of her educational institutions. But we think the character of the act unfortunate, because it appears to shield the Curators in that conduct of the Agricultural College which the farming community so soundly denounce. We are friends of the College as our resolution of last year shows, and as the tenacity with which we hold our present position proves.

### THIRD DAY.

The Board met according to adjournment.

*Present*—Messrs. Harris, Colman, Tilden, McCullough, Hall, Brown, Husmann, Stark and Shannon, *ex-officio*.

On motion of Mr. McCullough, the reading of the minutes was dispensed with.

The subject of the Agricultural College being the order of the day, Dr. Shannon rose to a personal explanation. He referred to the report of his yesterday's remarks in the *St. Louis Times*, and desired to correct a mistaken impression. Dr. Shannon said :

MR. PRESIDENT : So far from urging the separation of the University and the Agricultural School, I was particular to insist that it was no part of my desire to have a re-adjustment of the established order. In the course of my remarks on yesterday I expressed the opinion that experimental farming should be conducted in different parts of the State to be eminently practical and successful. This remark may have given the impression printed in the *Times*, but I added that such experiments could be directed and controlled from Columbia. No member of the Board, so far as I know, has ever expressed a desire to remove the Agricultural College.

A. W. Alexander, Esq., on invitation, addressed the Board on the subject, and was pretty severe in his strictures upon the former management of the Institution. He said it had so retrograded in the estimation of the people that it had acquired the title of "Boone County Academy," and was scarcely considered a State institution. What was required was to make it a State University which would secure the support of the people as an institution worthy of patronage. He said it had been ruined by favoritism, which had been its bane. He had heard it remarked in the Legislature that instructors had been retained there who did not enjoy the public confidence. He thought to avoid this aspersion no residents of Boone or Phelps county should be selected as Curators. He said he spoke for that class of minds upon whom such an institution must rest. He said if they could satisfy the educational classes that was all that would be necessary, but this had not been done.

Col. Colman spoke of the distinguished services of the late President Read, and reprimanded constitutional grumblers. He felt that the opposition to the University was really without foundation.

There were some questions of policy upon which he differed from his colleagues in the Board of Curators. He had opposed the establishment of the law and medical departments. He had been a Curator during the administration of Dr. Read, and felt satisfied that he deserved the highest praise for what he had done for the cause of education in Missouri during his term. We should support the Institution as a whole and make it a credit to the State.

On motion of Dr. Shannon, the discussion on the Agricultural College was closed.

Prof. Swallow offered the following resolution, which was adopted :

*Resolved*, That this Board appoint a standing committee on the Agricultural College, whose duty it shall be to visit the College, if possible, at its annual examinations, and to assist in the examinations and in the awarding of the prizes given to the various classes, and report to the annual meeting of this Board.

On motion of Dr. Shannon the following resolution was adopted :

*Resolved*, That this Board, recognizing the beneficial effects to flow from the free discussion to which we have listened upon the subject of the Agricultural School, extends a hearty invitation to the President of the State University and the Dean of the Agricultural College to meet with it all times and participate in its discussion.

Mr. Harris, President, then rose to vindicate the Board against what appeared to him as a severe attack upon the Board last evening. He regretted that President Laws had assumed the position that the Board was hostile to the real interests and legitimate objects of the Agricultural College. He felt that a feeling had been aroused for which there was no adequate reason. He had been a strong advocate of the original isolation of the Agricultural College from the University, although he was a resident of Boone county. He declared that the records of the Board showed it to be the permanent friend of the College. He made an interesting reference to his labors with Major Rollins in behalf of the University.

Dr. Laws, President of the University, said as much had been said about his remarks of the previous evening, as reflecting upon the Board, he desired to explain his position. He did so to the evident satisfaction of the members. He said he was incapable of a desire to detract from the merits of his predecessor, and denied having done so as had been alleged. He said, however, the discussion of the question of the existence and perpetuation of the State University was not a matter of manners or of men, but of principle. He said those who were making vague and indefinite criticisms upon the manner and plan of operating the institution, were the enemies of the University and not the friends. There were two points upon which the success of the thing hinged was, one that the location was permanently settled, and the other, that the plan of the institution should be accepted.

Hon. J. S. Rollins said that he was absent during the first hour of the session, and did not hear the remarks made, but understanding that there were reflections cast upon the late President Read, he felt called upon to bear testimony to his eminent services, and to repel any insinuations to the contrary.

On motion the Board took a recess till 2 p. m.

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## AFTERNOON SESSION.

On motion of Mr. McCullough, the regular order of business was suspended, and the election of members to fill vacancies proceeded with.

The Secretary stated that the members whose terms expire are J. W. Harris, N. J. Colman, M. V. L. McClelland, and Luman A. Brown.

To fill the first vacancy, Mr. Harris was nominated and received ten votes, and was declared elected.

To fill the second vacancy, Mr. Colman was nominated and received ten votes and was declared elected.

To fill the third vacancy, M. V. L. McClelland was nominated and received nine votes, and was declared elected.

L. A. Brown was nominated for the remaining vacancy, and received ten votes and was declared elected.

The Secretary stated that he had received a letter from Mr. Knox Brown, tendering his resignation. The resignation of Mr. Brown was accepted.

Dr. Shannon nominated Mr. T. A. Charles, of Jefferson county, to fill the vacancy. Mr. Charles peremptorily declined.

Mr. Tilden nominated Mr. Edwin Douglass of Jefferson county, who received nine votes, Mr. Charles one vote: Whereupon Mr. Douglass was declared elected.

The organization of the new Board was deferred until after the present session was concluded.

Mr. L. A. Brown, from the Committee on the visitation of the Agricultural College, presented the following

#### REPORT :

MR. PRESIDENT: Your Committee on Visitation of the Agricultural College, appointed at the last annual meeting, whose report was included in the Eleventh Annual Report, and to whom this report was referred back, beg leave to submit the following:

In reviewing the report of the committee, made by Messrs. Kinn y and Monteith, we find no occasion for unfavorable criticism on the report of last year; we believe that the committee, in that report, faithfully communicated the information they obtained, except that there are one or two statements of figures which seem to need revision. We do not, however, endorse the opinion there expressed, that it would have been better to have located the "Agricultural College" at some other point in the State; and we are opposed to any agitation of that subject, and under its new dispensation we have large hopes of the onward and upward movement of the University, and especially of the Agricultural College, and this Board hereby pledges itself to a cordial and hearty support to the Curators of the State University in their efforts to make said University all that its warmest friends could desire.

L. A. BROWN,  
D. L. HALL,  
J. L. McCULLOUGH,  
JOHN MONTEITH.

Mr. Monteith desired to place himself on record, as not agreeing to that part of the report touching the separation of the Agricultural College from the University. He had at the time the report was first drafted consented to embrace that remark, and he did not propose now to go back upon himself, while he was opposed to the agitation of that subject under the present circumstances.

The report was accepted and the committee discharged.

On motion of Mr. Hall, Prof. Swallow was permitted to prepare such statements as he may desire regarding the Agricultural College, and that the same be printed in the next report.

Mr. Tilden presented the following on Agricultural Societies, which were adopted :

*Resolved*, That we call the attention of the judges of the county courts throughout the State, to section seven of this law, whereby they are authorized to appropriate out of the county treasury, for the benefit of such societies, the sum of one hundred and fifty dollars in any one year, for premiums, known as "The County Court Premiums;" and we earnestly suggest and recommend our county courts to take immediate action on this subject, and signify their intention to offer this premium the coming season, and thereby encourage and stimulate the organization of these societies, that hard times have done so much to depress. We believe it money well expended; the premiums will be given to citizens of your own community, and stimulate them to greater exertions, and the number of competitors will increase annually. We believe that a general exhibition, once a year, of the products of a county where one person's "best" is brought into competition with another person's "best," and the



community have an opportunity of seeing the finest and the best the country can produce, does more than anything else can do to encourage and promote these general interests, and that those counties sustaining such organizations, will surpass those that do not, in all of their improvements, and lead them in growth and prosperity.

*Resolved*, That we call the special attention of those interested in agricultural and mechanical pursuits throughout the State, to the State law, (to be found on page five, Missouri Agricultural Reports for 1875,) for the organization of societies to promote these interests. The plan is complete and good, and we recommend the organization of societies in every county or district in the State under this law, and we believe if these societies are formed, and send their delegates regularly, as contemplated in the act, to meet with and take a part in the proceedings of the Board at their annual meetings, they will materially increase the power and influence of this Board, as well as unite and strengthen the agricultural and mechanical interests throughout the State.

Mr. McCullough offered the following resolutions, which were adopted :

*Resolved*, 1. That the Legislature be requested to memorialize Congress to appropriate such sum of money as they may deem proper to obtain relief.

*Resolved*, 2. That as a Board, we heartily indorse the action of the conference of Governors recently held at Omaha, to consider the locust problem, in appealing to Congress to have the necessary investigations made to mitigate or prevent the evil.

The Secretary presented the claim of Regan & Carter, State Printers, for a debt contracted by Hon. J. F. Wielandy, former Secretary, amounting to \$78.00, which was referred to the Executive Committee for auditing.

The regular order being resumed, Col. N. J. Colman opened the discussion of the hog-cholera. He gave it as his opinion that a number of diseases were embraced in the same name, but that they all proceeded from one cause—malaria. It might be that quinine would prove effectual as a remedy. As the loss to the State exceeded \$1,000,000, no pains or expenses should be spared to circumvent the disease. The employment of a veterinary physician at an expense of several thousands of dollars annually would be a small matter in comparison to the value destroyed by disease. He advocated at least a recommendation to the physicians of the State to study the diseases—make *post mortem* examinations, and help the farmers to prevent or cure.

Mr. Brown followed in the discussion. He had lost a large number of valuable animals by the disease. He endorsed the sentiments uttered by Col. Colman as to the importance of the subject. He had learned that foreign markets are making a demand upon us for 3,500,000 hogs annually.

Dr. Laws spoke at length on the same subject, and recommended the proposition to urge the physicians of the State to take up the investigation. But the Board should address its suggestions to the medical associations rather than to physicians at large.

Col. Colman offered the following resolution, which was adopted :

*Resolved*, That the medical societies and physicians of Missouri be politely requested to make *post mortem* examinations of hogs dying by what is commonly called "hog-cholera," and make reports to the Secretary of this Board for publication.

Mr. Hall offered the following resolution, which was adopted :

*Resolved*, That the Secretary be requested and instructed to transmit the resolution just passed to the medical societies throughout the State, with the request that they call the attention of the members to the importance of the object aimed at.

Following the order of exercises, Mr. Hussman reported concerning the grape crop and prospect. He found little encouragement to those who look for pecuniary benefit from grape-growing. The rot, which did not give them much trouble in the vicinity of Sedalia, is a formidable obstacle in most parts of the State. This obstacle

had rendered the Concord almost useless. The Hybrids are subject to the same difficulty. Norton's Virginia and Ives, for the most part, escape. The Delaware, on account of its insufficient foliage, is very uncertain. The Elvira at present promises better than any other variety, and the large vineyardists about Herman are grafting their Concorde with the Elvira. He regarded this as the leading variety for white wine and for the table.

The old Board adjourned *sine die*.

The new Board was then called to order, with Dr. Shannon in the chair, and proceeded to the election of officers. The following gentlemen were unanimously elected by acclamation: John W. Harris, President; Henry T. Mudd, Vice President; John Monteith, Secretary; W. T. Essex, Treasurer.

A recess was taken till 7 p. m.

## NIGHT SESSION.

The Board convened, when, on motion of Mr. Hall, the regular order was suspended to hear the essay of Mr. Edwin Douglass on "Dairying."

Col. Colman moved that any gentleman whose reports or essays had not been reached, be requested to produce the same in writing to the Secretary, which was carried.

Mr. Stark then took up the subject of the grape prospect, and gave a favorable report of the crop in the Louisiana district. Concorde had afforded a good yield. Ives was excellent. He had found it advantageous to plant grape vines in orchards, and had found that when a vine was allowed to climb a tree, and then treated with moderate pruning, there was greater certainty of a crop.

The Board then adjourned.

## UNFINISHED BUSINESS.

The time of the annual meeting was so largely occupied with the discussion of the Agricultural College, that some important subjects included in the Programme of the Annual Meeting were left without attention. Of this unfinished business, the essays of W. H. Todd, the noted poultry breeder of Ohio, on "Practical Poultry Keeping," and that of E. A. Filley, Esq., of St. Louis, on Jersey Cattle, and that of Wm. Cam, Esq., of Iron county, on Middle-men, will appear in their proper place in this volume. It was hoped that the subject of the Stock Law would receive special attention from the Board. As this was not the case, it has been thought proper to refer to the matter as one to which special attention attaches, in view of the decision of the Supreme Court of the State upon the old stock law. The decision declared the law unconstitutional, on the ground, mainly, that in submitting the question of its enforcement to a vote of the counties, it virtually delegated legislative power to localities. The pecuniary loss resulting from this decision, in St. Louis county, was very great, not less, it is estimated, than \$100,000.

## EXPENSE OF FENCING.

A valuable article on this subject, embracing much study and research, was contributed to the eighth report by Rev. Charles Peabody. Upon careful investigation, Mr. Peabody found that the farmers of Missouri had built 228,265 miles of fence. The

average cost of this fencing—an average struck between the extremes of Virginia rail and plank fence—amounts to \$420 per mile, or in the aggregate, to \$95,871.300! Mr. Peabody remarks: “This is the sum which the farmers of Missouri have invested in *unproductive capital*. The interest on this—nearly ten millions of dollars—is lost every year. But this is not all; this immense amount of unproductive capital is constantly deteriorating, and needs a constant addition to keep it good.”

#### RAILROAD FENCES.

The same article finds the railroad fences of the State to have cost not less than \$5,160,000. This amount has been largely increased during the past five years. The annual expenditure of these railroads for fences is not less than \$516,000.

Then, notwithstanding the care taken to fence in railroad tracks, a large amount is paid by railroad companies each year in the shape of damages for animals killed. In a single year these damages cost the Iron Mountain Railroad Company \$24,142.43. From replies to inquiries addressed to the different railroads of the State, the following facts and figures are invested with much importance: From 1867 to 1875, the St. Louis and Iron Mountain Railroad Company paid for stock killed \$195,558.49. From January 1, 1876, to November 1, 1876, this road paid for the same object \$29,659.79. The claims for stock killed by the St. Louis, Kansas City and Northern Railroad during 1875, amounted to \$38,262.95; during 1876 (i. e. to November,) \$31,018.97.

From 1872 to 1875, inclusive, the Kansas City, St. Joseph and Council Bluffs Railroads paid for stock killed, \$118,344.99. Stock killed by the Missouri Pacific Railway during the years 1875 and 1876, amounted to \$23,328.00. The amount paid by roads more recently built, running but partially within the State, and many of them running no night trains, viz.: The St. Louis, Keokuk and Northwestern, Missouri, Iowa and Nebraska, Burlington and Southwestern, Quincy, Missouri and Pacific, St. Louis, Salem and Little Rock, is an annual average of \$2,000 a year. The average yearly amount paid by the Missouri, Kansas and Texas Railway for stock killed in this State is \$15,000. From the Hannibal and St. Joseph, and Atlantic and Pacific railways, we have no report. The average amount paid each year by five leading railroads of the State, (excepting the Hannibal and St. Joseph,) is \$185.193. It is fair to estimate that the two roads, unreported, pay not less than an annual average of \$30,000—making the total amount for seven railroads of \$165,000. Now is any person so blind as not to see that this loss is not charged to the stockholders, but comes directly back to the people who use the railroads, as Mr. Peabody says: “in the shape of increased tariff on freight and passengers.” The cost, then, of the fences of the State, the interest on the capital invested in them, the yearly expenditure for repairs, and the cost of stock killed by the railroads, represents the amount paid by the farmers of the State for the luxury of having *stock run at large*. The annual payment for renewal of fences (the life of a fence being placed at ten years) is set down at \$9,587,130. Tabulating the figures of Mr. Peabody, and adding those already derived from railroad statements, we have:

The amount of capital invested by farmers in fencing.....	\$95,587,130
Interest on the above at ten per cent.....	\$9,558,713
Per annum renewal account every ten years.....	9,558,713
Repair account per annum.....	456,530
Annual expenditure for stock killed.....	165,000
Total annual cost to the farmers of Missouri of fencing and allowing stock to run at large.....	\$19,738,956

### VALUE OF MISSOURI LIVE STOCK.

According to the last census, the total value of the stock of this State is \$68,642,615. To protect the cultivated fields, the meadows, the gardens and potato patches of the State, against the stock represented by this value, and to pay for the damages done to them by railroads by reason of their running at large, costs us nearly \$20,000,000, or more than one-third of the value of the stock.

These facts are brought to light simply to furnish our legislators with an incentive to enact for the State a just, wise and practicable stock law.

### STATE ENTOMOLOGY.

It is greatly to the credit of past Legislatures that the science of Entomology was added to the civil list. During the past few years of insect scourge, the farmers more particularly affected, have been firmly and surely guided by the strong hand of science. No better tribute to the practical value of science, to the art of agriculture, can be found, than has been illustrated in the investigations, timely warnings and prompt advice of our State Entomologist, Prof. C. V. Riley.

### DISTRIBUTION OF THE REPORT.

It may be well to remind the farmers of the State, in concluding the report proper of the State Board, that the best way in which to secure the annual report is to send directly to the Secretary the postage required for its transmission. This is usually about fourteen cents. A much better way is for clubs of farmers, Granges, and others similarly associated, to send for a package of reports by express or freight, and to levy a tax on each copy sufficient to cover the expense.

I can but bespeak the sentiments of the State Board when I express the hope that a better day is about to dawn upon our farmers, and that with industry, economy, and an earnest study of the advanced ideas of Agriculture, they may soon realize their best hopes, and soon come to enjoy a just participation in the wealth which they do so much to produce.

Respectfully submitted,

JOHN MONTEITH, *Secretary.*



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# REPORTS, ESSAYS, ETC.

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# REPORT ON THE "HOG-CHOLERA."

BY DR. H. J. DETMERS, KANSAS.

## INTRODUCTION.

The disease which prevailed during the year 1875 and the first eight months of 1876, to an alarming extent among the swine of the State of Missouri, and which has caused severe losses in several parts of the State, is known to the farmers by the rather queer name of "hog-cholera"—a name given indiscriminately to almost any malignant disease of swine, the nature of which is not understood by the farmer—and is probably the same malady which has been so destructive to the hog crop of Missouri, Illinois, Iowa and other States during the last five or six years. The Missouri State Board of Agriculture, taking the position that an enemy must be known before it can be conquered, and desiring to devise means enabling the farmers of the State of Missouri to stop the ravages of the plague, and to save, if possible, the lives of those animals already attacked, requested the undersigned to investigate the disease in its various forms and phases, as to its nature, symptoms, morbid changes after death, and its causes, in several parts of the State, and to suggest means of prevention, and a rational treatment. The request of the State Board of Agriculture has been complied with. The investigation has been made. It was commenced in the fore part of August (August 11), and extended to the fore part of September (September 4). Several hundred sick animals have been examined in various parts of the State, but especially in the counties of Jackson, Lafayette and St. Charles, and numerous post-mortem examinations have been made, also at various places and at different times, on animals that had just died, and on animals affected with the disease in different stages of development, and killed by bleeding, for that special purpose. The premises on which the diseased animals were kept have been carefully examined, and the treatment and care which the latter had received before getting sick, or the mode and manner in which they were kept, have been ascertained by diligent inquiry and observation. Consequently sufficient material for a report has been collected.

## THE NATURE OF THE DISEASE.

The morbid process presents itself in a majority of cases, as a *catarrhal rheumatic*, and in others as a *gastric-rheumatic* or *billious-rheumatic affection*, and exhibits always more or less plainly, a decidedly typhoid character. As a catarrhal rheumatic affection it has its principal seat in the mucous membranes of the respiratory passages in the substance of the lungs, in the pulmonal pleura or serous membrane coating the external surface of the lobes of the lungs, in the costal pleura or serous lining of the internal surface of the chest, in the diaphragm and in the pericardium or serous bag enveloping the heart. As a gastric-rheumatic affection, the principal seat of the disease is



found in the abdominal cavity, but especially in the liver, in the spleen or milt, in the large and small intestines, in the kidneys and ureters, and in the peritoneum or serous membrane lining the interior surface of the abdominal cavity and constituting the external coat of most of the organs situated in that part of the body. Hence the name Hog Cholera is an ill-chosen one; it tends to convey the idea that the disease in question is similar to, or identical with the cholera of men, which is not the case; therefore the appellation "hog cholera," which has already led to a great many mistakes in regard to treatment and measures of prevention, should be abolished at once, and a more appropriate name should take its place. As such a one I wish to propose "*epizootic influenza of swine*," for two reasons: First, the disease in question bears, in all its morbid features, and especially in the diversity of its forms, produced by the differences in the seat of the morbid process, a striking resemblance to the yet well-remembered epizootic influenza of horses, which swept the whole country, a few years ago, from the Atlantic to the Pacific; second, I admit it might be more convenient to select a name derived from a conspicuous and characteristic symptom, or from an important and constant morbid change—pleuro-pneumonia of swine, for instance—if the main seat of the morbid process was always in the respiratory organs, or invariably the same in every patient. But as this is not the case, as the seat of the disease is found not only in the respiratory apparatus, but also, in a large number of cases, in the parts and organs connected with the digestive process, and, in some cases, even in the centers of the nervous system, a name had to be chosen that is comprehensive enough in its meaning to cover all the different forms under which the disease is able to make its appearance, and at the same time sufficiently distinct to prevent any diagnostic confusion. As such a name, I cannot think of any that would answer better than that of epizootic influenza of swine, which, therefore, I recommend for general adoption.

### SYMPTOMS AND MORBID CHANGES.

As the morbid process can have, and has, its seat in various organs or parts of the animal body, the disease presents itself in different forms, and manifests its presence by different symptoms, so that, at any rate, besides other complications, two principal, and two subordinate, forms or varieties must be discriminated.

#### I.—THE CATARRHAL RHEUMATIC FORM.

This is the most frequent of the two principal forms. The morbid process has its main seat in the respiratory organs; the disease presents the features of a respiratory disorder, and either the catarrhal or the rheumatic character predominates, or both are equally developed. If the latter is the case, the whole respiratory apparatus may be found diseased. If the catarrhal character is the one that is most developed, the principal seat of the disease will be found in the larynx, in the windpipe, in the bronchial tubes, and, to a larger or smaller extent, in the substance of the lungs; and if the rheumatic form is the predominating one, the principal morbid changes occur in the serous membranes of the chest (the costal and pulmonic pleura and the pericardium), and also, to some extent, in the tissue of the lungs. In most cases, however, the catarrhal and the rheumatic character are blended with each other, and the respiratory passages, the tissue of the lungs and the serous membranes, or parts of them, are more or less diseased.

Animals afflicted with the catarrhal rheumatic form indicate the presence of the disease by a short, more or less hoarse, hacking cough—generally one of the first symptoms—by difficulty of breathing, a panting or drawing motion of the flanks at each breath, by holding the head in a peculiar, stretched and somewhat drooping posi-

tion, by a slow and undecided gait, a peculiar hoarseness when caused to squeal, etc. The attending fever is severe enough to announce its presence by unmistakable symptoms, such as accelerated pulsation, changeable temperature, etc. Some of the sick animals show at the beginning of the disease a tendency to vomit, and have diarrhoea, while others are more or less constipated from the first, and remain constipated till the disease is ready to terminate in death. If the catarrhal character is the most prevailing, but especially if the morbid process has developed itself principally in the throat and in the windpipe, more or less outside swelling (quincy) will make its appearance.

At the post mortem examination, some important morbid changes will be found invariably in the lung. Portions of the same have become impervious to air by being gorged with exudation. The diseased tissue has lost its spongy texture, has become heavier, and more solid, similar in appearance and consistency to a piece of liver—a condition called hepatization. In some cases the diseased or hepatized parts of the lungs present a uniform, red, or reddish-brown color, and indicate that the exudation has been produced, and been deposited in the tissue of all the diseased lobules, at the same time, or without interruption. In other cases, the single lobules in the diseased portion of the lungs present different colors; some are red, some brown, and others gray or yellowish-gray, which give the whole hepatized part a somewhat marbled appearance, and shows that the exudation has been produced and been deposited at different periods. The gray hepatization, which is the oldest, and the brown, which comes next in age, contain frequently a few tubercles, or even here and there a small ulcer interspersed. Otherwise neither ulceration nor suppuration has been observed. Important morbid changes are usually found also in the serous membranes of the thorax. The same consist in a more or less firm coalescence between parts of the pulmonary pleura and the corresponding parts of the costal pleura, and in an accumulation of a larger or smaller quantity of straw-colored water or serum in the chest. In other cases, those in which the rheumatic character has been predominating, the morbid products of the diseased serous membranes are frequently very copious; the adhesion between the pulmonary and costal pleura, or between the external surface of the lungs and the internal surface of the walls of the thorax, is usually very extensive; and in some cases parts of the posterior surface of one, or of both lungs, are found firmly united with the corresponding parts of the diaphragm, or membranous partition, which separates the chest from the abdominal cavity. The quantity of serous exudation or straw-colored water deposited in the chest is often very large, and the pericardium, too, contains in most cases a larger or smaller quantity, sometimes enough to interfere seriously with the functions of the heart, and to constitute thereby the immediate cause of death. The blood is found to be thin and watery in every case, and coagulates rapidly to a uniform, but somewhat pale red clot of a loose texture. Its quantity is always very small.

#### II—THE GASTRIC-RHEUMATIC FORM.

This form presents itself not quite so often as the catarrhal-rheumatic, but is fully as malignant, and constitutes the second main form which the disease is bound to assume. The morbid process has its principal seat, and produces the most important morbid changes in some of the organs situated in the abdominal cavity, but especially in the liver, in the spleen or milt, in the kidneys or urethra, in the intestines or guts, and almost invariably in the peritoneum or serous membrane, which lines the interior surface of the abdominal cavity, and constitutes the external coat of nearly every intestine.

The symptoms which present themselves while the animal is living, differ not very

essentially from those observed in the catarrhal-rheumatic form. The short, hacking cough, characteristic of the latter, is more or less wanting; the difficulty of breathing is less plain; the weakness in the hindquarters, and the staggering or unsteady gait, observed only in a limited degree in the catarrhal-rheumatic form, is more conspicuous, and the fever is fully as high in one form as in the other.

In severe cases the affected animals arch their back, or rather the lumbal portion of the same, to a very high degree, so that the outline of the back resembles somewhat that shape of an S. I observed this especially in those cases in which the morbid process had established its seat in the kidneys and in the ureters, and in which a large quantity of serous exudation or straw-colored water had accumulated in the abdominal cavity.

Animals affected with the gastric form show usually more or less costiveness of the bowels. The dung is of the consistency of shoemakers' wax, and is voided in small, irregular-shaped balls, which are usually coated with a layer of grayish or discolored mucus. Still, if the disease is near its fatal termination, the constipation, in many cases, gives way to a profuse and very fetid diarrhoea, which may be looked upon, in every instance, as a very fatal sign, and a forerunner of death.

The principal morbid changes, as I have found them, are as follows:

1. Degeneration of the liver, brought about by a copious exudation infiltrated into the tissue of that organ. Such a degeneration, although not a constant morbid change, is found quite often. In some not very frequent cases, a few tubercles, and in others still less frequent, even a very few small abscesses have been found imbedded in the diseased substance of the liver.

2. Morbid enlargement of the spleen or mit. I found this change in nearly every case. In some cases the enlargement was not very conspicuous, but in others the spleen was more than three times its natural size, was perfectly gorged with blood, presented a dark, black-brown color, and was so soft that very slight pressure with a finger was sufficient to sever its tissue.

3. In quite a large number of cases I found either one or both kidneys diseased, enlarged, and presenting an inflamed appearance. In one case, both kidneys and both ureters exhibited a high degree of inflammation and considerable gangrenous destruction. The latter, however, was probably not a consequence of the disease; the animal had been drenched repeatedly with oil of turpentine, and was the only one in which I found any gangrene. In another animal, which, by the way, was already convalescent, and was killed by bleeding, I found one kidney enlarged to three times its natural size, its pelvis very much distended and its funnel-shaped ureter dilated to such an extent, where it proceeds from the kidney, as to present a diameter of nearly one inch and a half. The walls of the ureter were very thick and callous, especially at the anterior, funnel-shaped end, and the latter contained in its interior a semi-solid, fibrous substance, which occupied the whole cavity and extended even into the kidney.

4. In some cases I found the membranes of the intestines or guts, but especially those of the jejunum or small intestine of the coecum and colon or larger intestines, and also of the rectum in a more or less inflamed and degenerated condition. In two cases a whole convolution of the jejunum had united to an almost solid bunch. On opening the latter I found in each case all three membranes, but particularly the external or serous membrane and the internal or mucous membrane, very much swelled and degenerated, the passage nearly closed, and in a small cavity in the center of the bunch one or two large round worms (*ecchinorhynchus gigas*) imbedded. In another case I found, besides other morbid changes, a few round worms in the stomach and in the mucous membrane of the guts or intestines a large number of callous scars, such

as are usually left behind where the gigantic *echinorhynchus* or hook-headed worm has been fastening itself. These three cases just mentioned are the only ones in which I have found any entozoa or worms in the digestive canal.

5. In almost every case I found larger or smaller portions of the peritoneum or serous membrane, which lines the inner surface of the walls of the abdominal cavity and the external surface of nearly every intestine, swelled and more or less inflamed, and morbidly changed. In some cases even a coalescence between parts of the intestines, especially jejunum and rectum, and the walls of the abdominal cavity had been effected. In one case a part of the jejunum had become firmly united to the lower border of the right lobe of the liver, and in another the whole rectum adhered so firmly to the upper wall of the pelvis and of the posterior part of the abdominal cavity, that it required the use of a knife to effect a separation.

6. I found, in every animal that had been affected with the gastric-rheumatic form of the disease, a larger or smaller quantity of straw-colored water or serum, and small lumps and flakes of coagulated fibrine in the abdominal cavity; in some cases the quantity was quite a large one, and in others the quantity was comparatively small.

Those cases must be considered as subordinate forms, in which either one of the principal forms—the catarrhal-rheumatic and gastric-rheumatic—is essentially modified by being complicated with an affection of the brain and its membranes, or with a serious disorder of the lymphatic system. Hence, two subordinate forms have to be added.

### III—THE CEREBRO-RHEUMATIC FORM.

The same though always blended with and in a certain degree subordinate to one of the two principal forms, has been observed in a large number of sick animals. The latter, besides exhibiting all the symptoms of one or another of the principal (catarrhal-rheumatic or billious-rheumatic) forms, show also plain indications of a morbid affection of the brain. These indications consist principally in partial or perfect blindness, a very staggering gait, and aimless movements in general.

On opening the skull I found invariably more or less swelling in the membranes enveloping the brain, a larger or smaller quantity of serum deposited inside of the hard-membrane (*dura mater*), the substance of the brain more or less softened, and the small cavities or ventricles of the latter organ filled with serum. The other morbid changes found at the post-mortem examinations are the same that have been described under the head of their respective form.

### IV—THE LYMPHATIC-RHEUMATIC FORM.

The same, too, has been observed quite often, but always as a complication of one of the principal forms, described under 1 and 2. The whole morbid process presents a somewhat scrofulous character. The lymphatic system is plainly affected; tumors and ulcers showing a scrofulous character, are found in various parts of the body, but especially on the gums. Hence there can be no doubt that such cases, although complicated and blended invariably to such an extent with one or another of the main or principal forms as to make it impossible to draw distinct lines, have to be looked upon as a subordinate form with a lymphatic character.

I have been informed repeatedly by reliable persons, that in some of the sick animals cutaneous eruptions have constituted one of the most conspicuous symptoms of the disease. If this is a fact, it is possible that yet a fifth, erysipelatous, form has to be added. Still, I have had no chance to examine such a patient, notwithstanding that I have seen a large number of sick animals, exceeding, I should judge, 1,000; and am, therefore, not prepared to decide whether the cutaneous eruption is a product of the

same morbid process which is at the bottom of the other morbid changes, or whether the same is an independent disease, and merely an accidental complication.

It is probably not necessary to mention that all the morbid changes which have been described as the products or attendants of a certain form, are but seldom found as a total in one and the same animal, as one or more of them are usually missing or but little developed. Neither will it be essential to state that even the two principal forms of epizootic influenza of swine—leaving the subordinate forms out of consideration—are scarcely ever observed entirely independent of each other, or without being complicated in the least with any other form; that, on the contrary, the gastric-rheumatic and the catarrhal-rheumatic are, in many instances, blended and complicated with each other to such an extent as to make it impossible to decide which one has to be considered as the most predominating. In such cases the symptoms, too, are blended with each other, and morbid changes, frequently of equal importance, are found in both large cavities in the chest and in the abdomen. These facts are easily understood by any one who is at all familiar with pathology and with morbid anatomy. The main or fundamental character of epizootic influenza of swine is always rheumatic, and the principal seat is in the system of the serous membranes, abounding in every large cavity of the animal body. Serous membranes not only line the interior of those cavities, but constitute also the external coat of nearly every internal organ. Hence it is but natural that such a disease should localize in many different parts of the animal organism, to produce, in consequence, different morbid symptoms, and to cause different forms of disease. It is true, in some cases the disease exhibits a prevailing catarrhal character, but if it is taken into consideration that the causes of rheumatic affections and of catarrhal diseases are often essentially the same, and that the seat or character of a disorder depend frequently upon an individual predisposition of the animal, a further explanation will not be needed.

#### THE CAUSES.

To ascertain the causes has been my principal object. It was, therefore, necessary to observe a large number of cases, and to investigate the disease in different localities. This I have done, and have come to the conclusion that some of the causes—and I think I am not mistaken if I say the most important ones—are of such a nature as to admit removal, notwithstanding that they are diverse and numerous, and have their source, to a certain extent, in the manner of farming and stock-raising customary in the West. Although I will not deny the possibility of an existence of certain agencies of a so-called cosmic or telluric character calculated to act as a cause or to contribute in producing the disease, I must confess I have not been able to discover anything in the whole morbid process, nor any morbid change that cannot be the product of those noxious influences which I consider as the main, if not exclusive, causes of the disease, and which, in my opinion, are well able to produce every one of those morbid changes which I had an opportunity to observe. Those injurious influences, or agencies, which I am obliged to consider as the principal causes, act in different ways, and, for a better survey, may be divided in two classes.

As belonging to the first class, I look upon everything that is apt to cause an interruption of the perspiration, and in the second class I place all such noxious influences as are able to interfere directly with the process of respiration, and all such foreign substances as enter the respiratory passages, and cause thereby congestion and inflammation of the respiratory mucous membranes and of the tissue of the lungs. There are, also, as I have already mentioned, some other minor causes or agencies which contribute, in one case more, in another less, to the development of the disease, or which

are able to cause the character of the same to more typhoid. These I will discuss under the head of aggravating or auxiliary causes, after I shall have disposed of the main or principal causes.

1. Injurious influences which act as a cause of the disease, by producing an interruption or partial cessation of the perspiration. These influences are numerous, and of much greater importance than one, who looks at them superficially, may be inclined to suppose. The skin of an animal is a very important organ; it not only serves as a protecting tegument, but has also other vital offices which are scarcely of less consequence to the welfare of the animal organism than those of the lungs. The skin discharges, through its pores, a large amount of wasted material, gaseous and fluid, and absorbs aeriform and fluid substances from the outside world. Consequently it may be looked upon as an organ whose duty it is to supplement the functions of several other organs, but especially those of the lungs and of the kidneys. To ascertain the effects of a total interruption of the functions of the skin upon the animal organism, interesting experiments have been made by Bouley, Magendie, Gerlach and others. A complete interruption was brought about by covering the skin of various animals with an air-tight coat of varnish, grease or tar, and the results, according to Gerlach, have been as follows: "Accelerated pulsation, extraordinary fullness of the arteries till an increased discharge of urine made its appearance, somewhat accelerated breathing, trembling of the whole body, rapid emaciation, great debility, augmented secretion of an albuminous urine, which contained also some of the coloring matter of gall (bilifulvin and biliverdin), and a decrease of the animal temperature. The latter, however, became not very conspicuous before the animal had become emaciated and was near dying. The animals (horses) so treated died in three to ten days." Pigs coated all over with grease, for the purpose of killing lice, died within a week, and showed the same symptoms.

The office of the skin, at least as far as the processes of elimination and absorption are concerned, bears also a very close relation to the functions of the diverse serous and mucous membranes. It is true, if the skin is disqualified to perform its allotted duties, or if the latter are interrupted by some means, the same will partially be performed, but partially only, by those organs named—the lungs and the kidneys—which, in such a case, will make extraordinary efforts to maintain the equilibrium in the organic change of material, as indispensable to the preservation of health. Still, as I have said, these organs, in addition to their own duties, can only partially perform the functions of the skin; certain parts of the wasted material, constantly produced, will not be discharged, but will remain in the organism. The lungs, the kidneys, the serous and the mucous membranes, if I may use the expression, will be overburdened, and the consequence will be that just those organs will be the first ones that become diseased, or that will have to suffer from over-exertion and from the injurious effects necessarily produced by a retention of wasted material in the organism, and by a constant loss of organic compounds that cannot be spared. That such a loss is taking place, if the perspiration is interrupted, has been proved by the experiments of Prof. Gerlach, which show that the urine in such a case carries off albumen. Further, that such an interruption must necessarily produce a disturbance in the circulation of the blood, which results in an extraordinary flow of blood to those organs—lungs, kidneys, etc.—burdened with increased functions, and constitutes in that way a cause of congestion and subsequent inflammation, is too evident to need any further explanation. At any rate, these facts will be very plain to any one who has ever suffered from a cold.

The perspiration—perceptible and imperceptible perspiration—can be interrupted,

or in other words, the skin can be disqualified to perform its functions by several means; for instance, by a disturbance or partial interruption of the circulation of the blood in its capillary vessels, by congestion, inflammation or degeneration of its tissue, or of a part of its tissue, by a closing of its pores by mechanical means, etc. This granted, it remains to ascertain if those hogs and pigs which have been, or which are yet, affected with the epizootic influenza of swine (erroneously hog-cholera), have been subjected to one or more of those just named influences or agencies able to cause an interruption or partial cessation of the perspiration. Taking the facts just as they have presented themselves, that question must be answered in the affirmative. My investigations and my inquiries have convinced me that in all those hogs or pigs which have suffered from, or died of, that disease, one or more of those influences or agencies have been at work, as I shall try to show.

1. All animals affected with that disease—at any rate all those which I have seen, and I have seen a very large number—were exceedingly lousy. Lice irritate the skin, keeping it in a semi-inflamed condition, cause swelling, and finally a gradual degeneration of its external layer, and constitute therefore, beyond a doubt, a cause disturbing to some extent the normal perspiration.

2. All the hogs and pigs which have contracted the disease, have been exposed, night and day, to all the sudden changes of temperature and weather so frequent in our western States. Some of the animals have been kept in small, wet, and dirty yards or inclosures, without a roof to protect them; they had to suffer during the day from the rays of the sun, and from the heat which naturally accumulates in a small space or lot walled in by a tight fence, and is constantly increased by the decomposition of wet manure and other organic substances. During the night the same animals were exposed to the chilling influence of the cold night air, and the frequently very heavy dews, not to mention the effects of severe rains and thunder storms. Further, after each heavy rain, the animals thus kept had a chance to get their whole body covered with mud, and the pores of their skin thoroughly closed, but an opportunity to get rid of the dirt by taking a bath in clean water, was never given. Such influences, evidently, are very apt to cause irregularities in the circulation of the blood in the capillary vessels of the skin, and, in consequence, an interruption of the perspiration. Other animals have been kept in comparatively large herds and have been allowed to run at large in a barnyard, in a so-called hog lot, in the woods, etc. These, too, were exposed more or less to the burning rays of the sun during the day, but during the night, the same, in most cases, found shelter under a corn crib, under an old stable, or an old barn, or, at any rate, in the closest or dirtiest places, where they lacked room, and where they often crowded on top of each other when retiring to sleep. As a consequence, the animals became heated, and perspiring, but took cold and became chilled when they rose in the morning from this common lair. A sudden cooling, however, or a sudden reduction of the temperature of the surface of the body, is apt to effect a contraction of the capillary vessels of the skin; hence, a diminished supply of blood, and, in consequence, a decrease or partial interruption of the functions of the skin. The animals, thus suddenly cooled by the cool morning air and the wet dew, become, in the course of the forenoon, again exposed to the rays of the sun and the heat of the day, which induce them to go to the first best pool of water—if one was accessible—to take a bath. This is all right and well enough, because in the summer a hog should have access to water, and an opportunity to take a bath as often as it desires. In all those places, however, in which the disease has made its appearance, I have found the water to which the hogs had access almost invariably so shallow, and of such a limited quantity, that the bathing and wallowing of one or of a few animals was sufficient to convert the same into a

sticky, semi-fluid mud. Consequently, if the herd was a large one, only a few animals—and these invariably the stronger and most active ones—had now and then a chance to find clean water, and to reap real benefit from taking a bath. All others, but especially the younger and smaller animals (shoats), were compelled to wait till the first comers were through with their bathing, and had changed the water to mud; the former, therefore, had scarcely ever an opportunity to clean themselves from the mud of the preceding day, and to open the pores of their skin by taking a bath in clean water. If they wish to take a little cooling, they have to be satisfied with taking a mud bath, and as every new bath is a mud bath again, the pores of the skin, as a consequence, instead of being opened, will become closed more and more effectually from day to day, till finally the perspiration will be thoroughly interrupted, and the result, disease, will make its appearance. It is different if the herd is a small one, for then nearly every animal will have sometimes a chance to open the pores of its skin by a bath in tolerably clean water, and the perspiration will not be seriously interrupted. That these directions must be correct can be proved by my observations, which show that in every large herd nearly all the younger and weaker animals (shoats) have become a prey to the disease, while the larger and stronger, or most active animals, which are usually the first ones to go to the water in the morning, when the same is yet tolerably clean, and which usually secure at night the best places in the common lair, have either remained exempted or have had the disease in a milder form and have mostly recovered. Finally, small herds have either suffered fewer losses, have been less severely attacked, or have remained exempted altogether.

The injurious effects upon the system of the animal, produced by the filthy and muddy condition of the water, which the animals so situated have been compelled to drink, will be explained afterwards.

3. *Agencies which interfere directly with the process of breathing, and foreign substances which enter the respiratory passages.* These, too, as already indicated, are of a different character. When I first commenced my investigation, it struck me that all those swine—pigs, shoats and grown hogs of every age and description—which run at large in the streets and thoroughfares of Kansas City, Westport, Independence, Lexington and other places, and lead the most independent life possible, but do not congregate, go home in the evening, and belong to parties who own but one, two, or may be three animals, as also all those swine which are kept by themselves, either one by one or only a few together, and, finally, all those which are kept in comparatively small herds in pastures, orchards or woods, coated everywhere with grass, and perfectly destitute of dusty, bare ground, and of old manure heaps, are, remain, and have been, with rare exceptions, perfectly healthy. I say with rare exceptions, for it has been reported to me that a few of those swine running at large in the streets have died; but I have not been able to ascertain with certainty the causes of their death. On the other hand, all those animals which have been kept in yards, pastures or fields, etc., which consist, partially or wholly, of bare, dusty ground, or which contain heaps and accumulations of old manure, have suffered, and are suffering, severely, and the more so the larger the herd, and the worse the dust of soil and manure. In large herds, composed of one hundred head or more, the mortality has been as high as from seventy to ninety per cent.; in smaller herds the same has been from twenty-five to sixty per cent., and where only a few animals have been kept together, where, consequently, each animal was only compelled to inhale the dust kicked up by itself, and, occasionally, by one or two others, the mortality has been very low, has seldom exceeded ten per cent., or no fatal cases have occurred at all. Further, in all those cases in which the hogs or pigs have been compelled to inhale with each breath a large quantity of



soil and manure, ground to a fine powder by the rays of the sun and by heat, rain, wind, tramping and rooting, all the post mortem examinations—and I have made a large number during the last four weeks—have revealed, as principal morbid changes, a morbid affection of the eyes, inflammation of the respiratory passages (throat, wind-pipe, bronchial tubes), hepatization of the lungs in various stages of development, and, in some cases, even some tubercles, or a few small abscesses in the pulmonic tissue, while the serous membrane (pulmonic and costal pleura, pericardium and peritoneum,) presented themselves in a comparatively healthy condition, except in those cases in which the causes described under 1 had acted together with those under discussion.

If these facts just related are duly taken into consideration, scarcely any doubt can remain as to the constant inhalation of powdered soil and manure constituting one of the principal causes of the epizootic influenza of swine.

As another noxious influence, injuring the organs of respiration, may be considered the effluvia emanating from old, decomposing manure heaps, or farm accumulations of filth and dirt in pig-stys or hog-yards, but as these are only of subordinate importance, I do not deem it necessary to enter into further details.

4. *The auxiliary or aggravating, and predisposing causes.* As such I have to consider all those injurious agencies or noxious influences, which are calculated to promote or to develop the typhoid character of the disease, to weaken the constitution of the animal, or to produce a predisposition. As belonging to this class I have to mention first, as having a very injurious effect upon the animal system, an impure, foul or filthy condition of the water for drinking: and, secondly, the filth and manure which the animals are obliged to consume with their food. On most farms the swine are fed with corn in the ear, which, on a great many farms, is thrown to them with great carelessness in the very filthiest and dirtiest places, so that scarcely a kernel of corn can be picked up free from dirt or manure. That such a wholesale consumption of dirt and excrements must finally undermine the constitution of even the healthiest and most vigorous animal, and must give to any disease that may happen to effect the same a typhoid character, is too evident to need much explanation.

Another, though not quite so general cause, may be found in the following: In several places, especially in western Missouri, the corn of last year has not fully matured, was rather soft when put in the corn cribs, and as the climate is usually a dry one, the corn cribs on most farms are rather wide. The corn crop of last year was a large one, and, as a consequence, the corn in the lower parts of the large cribs, and in the center of the same, became heated and mouldy, in other places—on some farms at least—the corn cribs are without a roof, and the grain so housed, or not housed at all, became spoiled and mouldy in the spring by the influence of sunshine and rain. Such mouldy corn, nobody will deny, does not constitute healthful food, but weakens the organism, promotes disease, and tends to give any disease a decidedly typhoid character.

Finally, I wish to say a few words in regard to a hygienic mistake committed on almost every farm in the west. I refer to the practice of feeding the swine almost exclusively with corn, a practice which certainly is not calculated to produce healthy and vigorous animals, but which necessarily must result, as I shall try to show, in weakening the organism, and in creating a predisposition to disease. How much or how little this practice has contributed in producing the now prevailing epizootic influenza of swine I am not prepared to decide. I have, however, reasons to suppose that this practice has not been without influence. The organism of a domestic animal is composed of about fifteen to twenty elements, or undecomposable constituents of mat-

ter, united to numerous organic compounds. A constant change of matter is taking place, and a part of these elements in form of organic compounds, is constantly wasted and carried off by the various processes of secretion and excretion. The organism, therefore, in order to remain healthy, and to maintain its normal composition must receive, from time to time, an adequate supply of those elements, contained in suitable or digestible organic compounds, so as to cover the continual loss, and, if the animal is young, to produce growth and development. The simplest way to introduce these elements into the animal organism is to give food which contains them in nearly the right proportions. A few of these elements, besides hydrogen and oxygen, are sometimes, in the form of suitable compounds, contained in limited, though very seldom sufficient, quantities in the water for drinking; for instance, calcium in the form of lime, iron, etc. One important element—oxygen—enters the organism also in large quantities through the lungs and through the skin, but all others have to be introduced wholly, or almost wholly, in the form of food. Almost all kinds of food, however, milk, perhaps, excepted, lack some important elements in their composition, contain others in insufficient quantities, and still others in a greater abundance than required. Therefore, if such a kind of food is given exclusively—corn, for instance—which is destitute of some of the mineral elements, and contains only an insufficient quantity of nitrogenous compounds, which are of so great an importance in the animal organization, irregularities and disorders in the exercise of the various functions, and imperfect development of certain parts and organs, will be the unavoidable results.

One may ask, if the causes of the disease are of such an ordinary character, how can it be possible that it has become such an extensive epizooty? The answer is not very difficult, and an explanation is easily given. At first, notwithstanding the most diligent search and patient inquiry, I have not been able to discover any injurious influences or agencies of a general character besides those enumerated, which, possibly might have acted as a cause. Secondly, the treatment or the keeping of the swine is essentially everywhere the same in all the Western States. The causes mentioned are, therefore, of a sufficiently universal character to produce an epizootic disease. Our western farmer, as a general rule, careless enough, if possible, in his treatment and care of his horses and cattle, usually thinks a hog is only a "hog;" can get along with "hoggyish" treatment, delights in nastiness, filth and dirt of any description; does not need a dry, comfortable and clean resting place during the night, nor clean and fresh water for drinking and bathing; nor shade and shelter against the burning rays of a western sun, against the cold dews of the morning, or the sudden changes of weather and temperature in general.

Somebody may object, and may say, if the principal causes of the disease have their source in the manner in which the swine are raised and provided for, which does not differ essentially from what has been since the country was first settled, how then does it happen, or how can it be explained, that the disease did make its appearance as an epizooty only a few years ago, and not immediately among the swine of the first settlers, or while the country was yet new, and is now increasing in violence from year to year? This question is not difficult to answer. While the country was new, pig stys, hog-yards, hog-lots or pastures, and the places which contained the water for drinking and bathing were not yet contaminated and impregnated to such an extent as they are now with filth and excrements; bare and dusty ground was less abundant, and the number of swine kept together on one place, as a general rule, was a great deal smaller. The disease will increase in malignancy and spread in the same proportion in which dung and dirt are allowed to accumulate, and in which the size of the herds is increased.

A great many farmers believe, nay, hold themselves convinced, that the epizootic influenza of swine is a contagious disease; and they have kindly furnished me facts which, I admit, point very strongly that way. To tell the truth I am not yet prepared to decide that question, because such a decision requires numerous experiments, and these I have not been able to make. Still, I am inclined to think the epizootic character, or the fearful spreading of the disease, can be explained satisfactorily without the existence of a contagion. The fact that the hogs and pigs running at large in the streets of the cities, with a few exceptions, are healthy, and remain exempted from the disease, goes far to show that the latter is not communicated by a contagion, as animals leading such a vagabond life are, as a general rule, much more exposed to the influence of contagions than any others.

#### DURATION OF THE MORBID PROCESS.

In some cases the disease has had a fatal termination within two days after the first plain symptoms of sickness have made their appearance, and a few cases have been reported to me, in which the animals have died within six or twelve hours; but I am inclined to think the first symptoms have escaped observation—a very common occurrence in diseases of swine. The average duration of the disease may be set down as from five to fifteen days. Still some animals have been sick from three to six weeks, but most of them have recovered, and then a part of that time belongs to the stage of convalescence. Or if the patients have died, the duration of the disease has been protracted by relapses.

#### PREVENTION.

The measures of prevention consist in removing the causes as enumerated above. If this is done, no other special treatment will be required to ward off the disease, and no medicines will be needed. To give medicine to a healthy animal is, under all circumstances, a bad practice, fraught with injury, and should not be done, unless it is intended to destroy injurious influences. To use medicine for the purpose of strengthening the constitution of an animal is simply folly, as just the opposite will be the result. But to the point: I am confident the epizootic influenza of swine, or the disease improperly called hog-cholera, will cease to make its appearance, or, at any rate, will become a very rare occurrence, and will lose its epizootic character, if first, every large herd of swine is divided into several small herds or lots, each containing about three or four animals; if, secondly, each lot is provided with a comfortable pen or place to sleep in, which is free from filth, dust and manure, is well ventilated and provided with a good roof; if, thirdly, every hog or pig has access, several times a day, or as often as temperature, weather and circumstances require, to fresh and clean water for drinking and bathing, either in a large trough or in a brook, creek or streamlet; if, fourthly, no filth, manure or dirt is allowed to accumulate in any of the stys, yards, hog-lots, or pastures, in which the hogs or pigs are kept; and if, finally, hogs and pigs receive always a suitable variety of sound and healthy food, which is not soiled with dirt or manure. I know very well some farmers will be dissatisfied with my advice, and would have preferred to be sent to the drug store for medicines. Others will think to comply with my prescription will be too much trouble altogether, and some of them may say: "If we cannot keep our hogs any more in the old 'hoggish' fashion, but must treat them like animals ought to be treated, we prefer to keep no hogs at all." Very well, if they do not keep any hogs they certainly will not lose any, and their neighbors, who continue to raise swine, and take proper care of them, will be the gainers in a two-fold respect. At first they will reap the benefit from the scarcity of hogs thus produced, and, secondly, they will be amply repaid by their swine for the care bestowed upon them. At any rate, it will pay much better for any one to

raise, for instance, fifty hogs, to keep them well in every respect, to lose none, and to develop them to first class animals (so-called Philadelphia hogs,) than to raise 100 or 200 head, to keep them "hoggish," to lose from fifty to seventy per cent., and to produce animals that figure as "scallwags" in the market reports. Moreover, the amount of food that is needed to produce 200 pounds of inferior, and frequently unhealthy, pork—if the pig is kept on a manure heap in the barn yard, or in a nasty hog-lot, and in the old, common and careless fashion—will easily produce 300 pounds of good, healthy and palatable pork, if the keeping of the animal is always in strict accordance with hygienic laws. If the latter are never violated, epizootic influenza of swine, I am sure, will not make its appearance; but if the mode of keeping swine is not changed, the disease will increase in frequency and in malignancy from year to year.

One remark I wish to make in giving my views thus candidly and in plain language to the public, it has been my sole object, not to blame any body, but to tell the truth—to point out the way which has to be pursued if it is desired to get rid of the disease, and to show the mistakes that have been committed, not by one farmer, nor by a few, but by a great many. Therefore, I ask every one who may find that he is guilty of having neglected his hogs, or of having treated them rather "hoggish," to accept what I have said in just that spirit in which it has been written, and he will be the gainer.

#### TREATMENT.

The treatment may be divided in two parts—a hygienic, and a medical treatment. The former includes a removing of the causes, and is alike in many, or even in most, diseases, of the greatest importance. The sick animal must be separated from the herd, and must be provided with a clean, dry, and well-ventilated resting place, which is not exposed to drafts of air, and which affords otherwise sufficient protection against heat, cold and wet. The same, further, must have, besides, pure air to breathe, clean water to drink, and healthy and easily digestible food to eat. If the sick animals are thus treated, and the causes promptly removed, a great many sick animals (provided, of course, they are not too far gone) will be saved by a proper medical treatment; but if these directions are not complied with, even the best medical treatment will be of very little avail. As to the use of medicines, I would recommend to give to each patient at the beginning of the disease a good emetic, composed either of powdered white hellebore (*veratrum album*) or of tartar emetic in a dose of about one grain for each month the sick animal is old, if the same is of fair size, but not exceeding sixteen to twenty grains, even if the animal is full-grown or several years old. The emetic is easily administered by mixing it with a piece of boiled potato, or, if white hellebore is chosen (which I consider as preferable), by sprinkling it on the surface of a small quantity of milk. Boiled potato or milk will not be refused by any hog unless the patient is already very sick or far gone, and in that case it will be too late to give an emetic. After the medicine has taken effect the animal will appear to be very sick, and will try to hide itself in a dark corner, but in about two or three hours it will make its appearance again, and will be willing, in most cases at least, to accept a little choice food, for instance, a boiled potato, a little milk, etc. At that time it will be advisable to give again a small dose of medicine, consisting either of a few grains (two to three, to a full-grown animal, and to a pig in proportion), of tartar emetic, or of the same amount of calomel, also mixed with a piece of a boiled potato; or, if appetite should not have returned, mixed with a pinch of flour and a few drops of water, and formed into small round pills. A sick hog, I will remark here, should not be drenched with medicines under any circumstances, for a drench, given by force, is very apt to pass down the windpipe into the lungs as soon as the animal squeals, and frequently causes instant

death. The tartar emetic has to be preferred, if the disease has its principal seat in the respiratory organs, or presents itself in its catarrhal-rheumatic form, and the calomel deserves preference if the gastric, or bilious rheumatic form is prevailing, but especially if the liver is seriously affected. Either medicine may be given in such doses as have been mentioned, two or three times a day for several days in succession, or till a change for the better will be plainly visible. It may also be advisable (but particularly if the typhoid character of the disease is very manifest) to mix for each hog or pig, now and then, a few drops of carbolic acid with the water for drinking, or with the slop. Animals that are convalescent and have been reduced very much by the disease, and are yet weak, should receive, mixed with their food, small doses of sulphate of iron (copperas) say from five to twenty grains, according to age and size, but the use of iron must be discontinued if the patient becomes constipated, or if the excrements turn black. Those convalescents in which the morbid process has produced considerable hepatization of the lungs will be benefitted by giving them repeatedly small doses (from ten to fifty grains) of purified carbonate of potash, for the purpose of promoting the absorption of the exudation deposited in the tissue of the lungs.

Externally, a good counter irritant, or blister, applied on both sides of the chest, and composed of cantharides or Spanish flies and oil (one ounce of the former to four ounces of the latter constitutes the proportion), boiled together over a moderate fire for half an hour, or in a water bath for one hour, will produce a very beneficial result, especially in all those cases in which the serous membranes of the chest constitute the principal seat of the morbid process. In most cases one application will be sufficient, provided the oil is thoroughly rubbed in and the disease has not progressed too far. If the first application should fail to raise a good blister (swelling and exudation), a second one may be made the next day. In those cases, however, in which the morbid process has made too much headway, or has wrought too much destruction of tissue to admit recovery, the counter-irritant will produce no blister and no swelling whatever, a fact which constitutes a valuable prognostic symptom, for it indicates that the vitality of the animal is already very low, and that a further treatment will be of no avail. Fontanels or setons have nearly the same effect as a vesicatory or fly-blister, but act slower, are less reliable and may otherwise cause some damage on account of the typhoid character of the disease by weakening the constitution of the animal.

In conclusion, I wish to offer my most sincere thanks to those citizens of the counties of Jackson, Lafayette and St. Charles, who have made my task a comparatively easy one, by showing me much kindness and rendering me considerable assistance. I am, however, under special obligations to D. L. Hall, Esq., Kansas City; Judge Lewis S. Ward, Esq., and Hon. J. B. Wornall, Westport; Col. Southern and Joe Bagby, Esq., Independence; Col. McClellan, at Wellington; Judge Gammon, Mr. Grimes and Alf. Hall, Esq., at Lexington; and Hon. G. W. Kinney, Mr. Selfridge and Mr. Orr, at Foristell, St. Charles county; for all these gentlemen have shown me special favors, and have done everything in their power to assist me in my investigation.

# THE DAIRY INTEREST IN MISSOURI.

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BY EDWIN DOUGLASS, PEVELY, JEFFERSON COUNTY.

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Of all the products of the farm, that of the dairy is by far the largest. This may seem a rash statement to some, but is, nevertheless, true. Not even the hay crop equals that of the dairy. The total annual product of butter, cheese and milk in the United States is estimated at \$800,000,000. Of this amount the State of New York produces one-third. No idea has been more commonly entertained than that good butter and cheese could not be made in the West, and that New York, Vermont and certain other small sections of the East had a perpetual monopoly of the dairy business. When we consider the vast value of the product, the importance of the dairy interest to the West and South cannot be over-estimated; and while farmers have been complaining so much of hard times and the difficulty of making both ends meet, it is strange that more attention has not been paid to this most lucrative branch of farming. But so firmly has the idea been impressed, for years, that an article good enough to command a remunerative price cannot be made outside of certain favored sections, that its correctness seems to be unquestioned. To show the fallacy of the idea as regards butter-making, at least to give a few general principles and rules, which, if intelligently and faithfully followed, will insure the making of a good article, will be the aim of this paper.

In this connection we will say that success is not confined to butter-making, but that cheese also can be successfully produced; the space allowed us for this article, however, will confine us to the consideration of the first only.

Various have been the reasons described why good butter could not be made in the West and South: climate, water, the inadaptability of the soil, etc., the universally miserable article found upon the table in these sections, or its total absence, naturally has so confirmed the belief that nature has placed some insurmountable obstacle in the way, that we find ourselves giving the reasons why a choice article cannot be made without even questioning the fact. However, in the last few years the belief that a "gilt-edge" article could not be made in the West, has received a rude shock by the wonderful improvement in certain sections. To-day, as fine butter is made in northern Illinois and southern Wisconsin as anywhere in the country. True, the average product is not equal to that of New York in quality; but here and there is found a dairyman who makes an article second to none of the New York makers. Every year their number is increasing. When we ask what is the reason of this change, we are told that

the Rock River country is very similar to the dairy sections of the East. It has certain peculiar features which, wherever possessed, we will find good butter, and where absent, poor. It is strange that fifteen years ago, when the butter made there was universally poor, these requisites were supposed not to exist, just as they are now supposed not to in other parts of the West.

After many years of experience in the wholesale butter and cheese trade in the city of St. Louis—having originally been engaged in the same business in New York, and for years procuring our total supply from the East; after having seen the West so improve as to furnish our market with its total supply, not even the finest grades being any longer brought from the East; after having made the manufacture of the best butter our study for years; after a long acquaintance with a large number of the best dairymen in the country, many of whom in the West have been our pupils, and who now market their product in eastern cities at top prices, and one of whom carried off the first prize at the Centennial over his eastern competitors, and, finally, after three years' practical experience in conducting a dairy farm in Missouri, we have no hesitation in declaring that the very best of butter can be made in any State in the West, and that even in the southern States an excellent article can be made, far superior to that which they generally procure from the northern States. We have no hesitation in saying that the only reason the make is generally so poor is owing to the ignorance of farmers as to the proper methods, or their want of ambition and industry to follow them.

The cause of the great improvement in butter-making in northern Illinois and Wisconsin is the fact that many eastern dairy farmers have settled there, who were skillful butter-makers. They would not accept the statement that the best butter could not be made there. They promptly plowed up the wild western grasses, and sowed the best pasture varieties. Procuring proper feed for their cows, and then applying the same skill and care that they had formerly used in the manufacture, they found themselves making as good an article as they ever had done East. It soon became known and appreciated, and they got good prices, while their neighbors were receiving only ten or twelve cents per pound. The latter have profited by their example, and to-day we see, as the result, this section furnishing all our western cities with their total supply, which was formerly drawn from the East. To their skill alone is due their success, and not to their location. This same skill will succeed just as well in Missouri or elsewhere. The localities are few where good butter cannot be made, if one knows how and wishes to do it.

In the following rules and requirements, necessary to be strictly complied with, we cannot indicate the best method to overcome the obstacles in the way of complying with each one; so many varying conditions will occur that many things must be left to the judgment and ingenuity of the maker. To those who desire more full and explicit instructions, we recommend Flint's Work on Grasses, and Professor L. B. Arnold's Work on Dairying.

First, for the production of good butter it is necessary to have good cows. The quality of butter is much affected by the quality of the cows, still, most sound, healthy animals will make excellent butter if all the other conditions are complied with. But the *very best* butter cannot be made from cows that give thin, blue milk, that yields only a small quantity of thin, light colored cream; such milk will make butter light colored and wanting in that firmness, fine grain and waxy texture which is characteristic of the best kind. But far greater than the difference in quality of butter from different cows, is the difference in the quantity they will yield. For success, then, in making dairying pay, as well as in making a fine quality of butter, the selection of cows is most

important. In Missouri, and most sections of the West and South, a good dairy cow is almost an impossible thing to find. In New York State the average make is 125 pounds of butter a year for each cow; in Missouri it is not near that, yet we cannot look for success in one who does not have cows that will make more than 125 pounds for the year, for he who does not pay more attention to the kind of cows he has than that, will be wanting in many other particulars. When we state that there can be found in New York dairies whose average is over 400 pounds a year per cow, it can be seen what a difference it must make in profit. It costs no more to keep a good butter cow than it does a poor one. The best way to select butter cows is by actual trial. Every dairyman should test each cow; if she does not come up to a certain standard, which should be as high as he thinks it practicable for him to attain, and never under 200 pounds per annum, he should get rid of her.

Our own observation and experience is that the Jersey or Alderney cow is the most profitable to keep for butter making. No race of cows can equal her in the annual product of butter, while for quality she stands unrivalled. All of the dairymen in the Eastern States who are especially renowned for the quality of their butter, and whose product commands those almost fabulous prices, ranging from 75 cents to \$1.25 a pound the year round, use Jerseys exclusively. The following are some of the advantages possessed by this race: Their milk and cream is much yellower than that of any other breed, enabling the dairymen, with good feed, to make a rich yellow butter, even in mid-winter. The globules of cream are much larger than those of any other breed, hence the cream rises much more rapidly and the milk does not need to be set so long. The envelopes of the cream globules are more tender, and hence the operation of churning is shorter and easier. This, and the large size of the globules, gives that exceeding firmness and waxy texture, such as no other butter has.

As to quantity of butter, numerous instances of large yields from certain animals can be given among nearly all breeds of cattle. Our belief, from our own experience, is that the *average* of the Jersey race is much larger than that of any other breed. This opinion seems to be gaining ground very rapidly among the most successful Eastern butter makers. During the last few years the demand for Jerseys has increased very much among them, until the larger proportion have at least a number of grades and a Jersey bull, and nearly all are anxious to get as much Jersey blood as possible, as fast as their means will allow.

As an example of what specimen Jerseys have done, we will mention only the well known instance of Mr. Motley's cow, Flora. This cow, after dropping her third calf, made, on ordinary keep, 511 pounds and two ounces of butter in a year. The largest yield in one week was fourteen pounds, the smallest six pounds. Instead of giving more instances of the yield of celebrated cows, we will give our own experience, which may be more satisfactory. During the past twenty-four months, our herd, which has increased gradually in numbers from about twenty-five to forty-five milking animals, full half of which are native cows, has at no time fallen as low in yield as one-half pound of butter each per day. In this estimate we count *all* animals that ever gave milk. There has always been in the herd a number of young heifers and farrow and dry cows. Estimating the average at only one-half pound per head a day, would give 182½ pounds of butter for each cow per year. But most all of the year our herd has made far over this amount, and some of the time over one pound each a day; hence it can be seen that the yield of the herd is far above 200 pounds each per annum. If we allow for the milk consumed by the calves—all the full blood and grade cow-calves being raised; also, if we count each heifer as one-half a cow, as is customary in making such estimates, and allow for quite a number of farrow cows which have been held over so



as to drop their calves in the fall for winter cows, we think the yield for mature cows, all fresh within the year, would amount to over 300 pounds each per year. Again, taken as it is, the yield would be estimated full low at three-fourths of a pound each per day, which would be 273 pounds each a year. What our exact yield has been we can not give, as the herd has been changed so much by sales and purchases. Of one thing we are satisfied, namely, that the yield of our Jerseys has been much better than 300 pounds per annum; that the native cows have been a constant load for the Jerseys to carry—although the natives are a selected herd and the result of constant weeding. We have occasionally churned the Jersey's milk by itself and found them to be making far the larger share. In the flush of spring and early summer milk, it has taken about twenty-two pounds or ten and twenty-three hundredths pounds of milk to make one pound of butter. During the fall and winter of 1875 and 1876, the amount of milk diminished at one time to as low as fourteen pounds or less than seven quarts of milk to the pound of butter for the mixed herd. The percentage of cream on the Jersey milk has ranged from eighteen to forty per cent. as extremes. We have made but few tests of the exact quantity of butter our individual Jerseys were making. During last June, judging that our cow, Darling, was doing unusually well, we set her milk by itself, and found her to be making seventeen and three-fourths pounds of butter a week, weighed when free from buttermilk and before salting. She was fresh the preceding March. Her feed was pasture and six quarts of wheat bran a day.

Next in order after the Jersey merit as a large butter maker, comes the fact that the cost of her keep is much smaller than that of other cattle. She is small in size, while as a general rule those animals which approach her in yield of butter, are large in size, and enormous milkers, which make up in quantity what they lack in quality. Generally, large milkers are large cows, and their immense bodies must be kept in condition before anything is given to milk. To keep up a full flow of milk in such a cow, will require at least double the feed that a Jersey will do well on. This fact has been very marked to us while keeping the Jerseys side by side with our best natives and good Durhams. Those cows which approach nearest to the Jerseys in yield, require full double the feed in winter. Throwing as much hay to the natives as they will eat up clean in one day, and the same quantity to the Jerseys at night, we have repeatedly found the latter with fully half left. The same has been our experience with feeding feeding grain. Fully as noticeable has it been in summer when on pasture. When the hot weather of July and August has dried up the pasture, and the heat has become so disagreeable to cattle that they will feed only in the cool air of morning or evening, we have repeatedly noticed that while all shrank in milk, the natives would lose fully one half, while the Jerseys would not one quarter of their flow. Again we observe, that the Jerseys stand the heat of summer much better than other cattle. Often have we seen the little thin Jersey out in the broad sun quietly feeding, while all the large cows of other kinds were standing in the shade or water, switching flies. At evening the latter come up with panting sides and lolling tongues, while the former appear as contented and comfortable as usual. This too has been the experience of all who have kept them in the southern States. While the lordly Short-horn almost invariably dies under the rigor of their tropical summers, the little Jersey has thrived well.

In this connection we wish to correct the impression that a Jersey cow is a small milker. While not noted so much for an immense flow when fresh, they hold out extra well, seldom going dry over four to six weeks, and many never doing so. Many are found giving from 13 to 22 quarts a-day, and when we estimate their yield for a year, but few will equal them.

To sum up we find that the advantages of a Jersey cow for the dairy are, first, she

will make the most butter; second, that butter will be of a superior quality; third, it will cost much less to keep her; fourth, the milk being so much richer, it will be less expense to milk, set, skim, churn, etc., in fact, the whole process of manufacture be cheapened.

But the great objection to most people will be the cost. We cannot get something for nothing, as a rule. In New York the market price of a good native cow is \$75.00. A good cow is one that will make 200 lbs. a year. We know a few small dairies of fifteen to twenty native cows, which will average about 300 lbs. to the cow. Such cows, it is true, did not cost a large sum. But in every case they are the result of a careful selection and weeding out by old dairymen all their lives. If we add the value of the labor and trouble, the loss on numbers of cows bought in that time which were not up to the standard, we shall find they have not been so very cheap. We do not believe that an offer of \$150.00 a head would tempt one of them to sell. But at that price they would be well towards a Jersey in cost. But to look at it in another light, suppose our dairymen purchase a number of cows, such as are called good, around him, at a cost of \$30. to \$40.00. Suppose they will average 125 lbs. per annum of butter, which is more than they probably will do. Suppose now, he purchases a Jersey for \$400.00, that will make 300 lbs. a year. Here is a difference of 175 lbs. in favor of the Jersey, which at 30 cents a pound would be \$52.50. This difference, with proper care, should continue at least 10 years. Hence in her life time the Jersey would yield \$525.00 worth more butter, or \$125.00 more than her whole cost over and above the yield of the cheap cow! Hence the Jersey would be the most profitable. In this estimate we have placed the figures more to the disadvantage of the Jersey than justice will warrant, and considered only the difference of her yield in quantity. Of course, in making a proper estimate, we should consider the difference in the quality of the butter, the difference in the cost of the keep, and the value of the calves, which, from the Jersey by a good bull, would be worth \$50.00 each, at a low estimate. Allowing 3c. per pound for the superior quality, and \$50.00 each for the calves, and \$10.00 a year for difference in keep and labor, we should have a difference of \$117.75, which in three years would pay the additional cost of the Jersey.

We have dwelt thus much upon the advantages of good stock in butter making, because in our experience the greatest difficulty in starting a dairy in Missouri is to get good enough butter cows. And it seems to us, that one great reason which tends to keep the Missouri farmer from engaging in dairying, is the want of any adequate idea of what a good dairy cow is, or what she will produce. In conversation with many of them we have time and again been met with unbelief, when mentioning some yield which is not at all wonderful. To gather together a first-class herd of butter cows from the native stock, is impracticable in this State. If one cannot afford to purchase a herd of the thoroughbred dairy breeds, nor send to the dairy section of the country for some first-class natives, his best plan is to raise a herd by crossing the best natives he can get with a Jersey bull. After three or four crosses he will have for all interests and purposes, except breeding, a herd as good or nearly so as thoroughbreds. Almost any farmer who can go into dairying can manage to get a Jersey bull. And if at the same time he can get two or three thorough bred cows, in a few years he will have, with proper care, a fine butter herd. In purchasing a bull, too much attention should not be paid to getting a cheap one, but instead to obtain a son of the very best butter cow that can be had. The bull is the foundation of the herd. Unless he is first-class, no success can be attained.

We can give no positive directions how to judge or select a good butter cow. That must come by experience. The only sure guide is actual trial. By weighing one day's

milk twice a month during the milking season, a fair idea of the quantity of milk can be obtained, and four or five trials during this period, showing how many pounds of milk are necessary to make a pound of butter, will enable one to judge accurately enough how much is made. Cows that are inclined to take on flesh and become beefy should be especially avoided. The two products are entirely antagonistic. The cow so often spoken of as the great desideratum of farmers, called the general utility cow, one which shall give a large quantity of milk and butter, and yet make fine beef when dried off, and whose calves will likewise mature rapidly, is not what the dairymen should aim for. Any great degree of perfection in the production of both will never be found in the same animal. The dairyman wants as nearly perfect an animal as possible for butter or cheese. The additional yield in them will much more than make up for any difference in the value of the calves for veal, and of the cow for beef when her milking days are over.

Next after good cows, it is necessary to have good feed and water. Good feed can be had in any moderately good farming section. Good, pure, clean, wholesome water can be had in most sections, either from streams, springs or wells. Where it cannot be had for both man and beast, dairying is impossible, and it is a poor country for any one to live in.

The best of all feed, is grass, but where it is impossible to obtain this in sufficient quantity, or of proper quality, a system of soiling can be successfully adopted. A succession of green crops consisting of rye, wheat, oats, clover, fodder, corn and roots will make excellent feed. Where pasture can be had, a mixture of seeds should be sown, varying with the character of the soil, climate, etc. To get a good close sod it is necessary to have a number of varieties of grass. In all the best old pastures of the east and the old world, from seventy to eighty varieties of grass will be found to the square yard. Nearly all Eastern dairymen practice feeding a little grain when cows are on pasture; and say it pays even in June. For winter feed early cut hay, fodder corn, wheat and corn, bran, oat, meal, corn meal, oil cake meal and root crops are all excellent feed which the dairymen will use in accordance with the facilities he has for obtaining them. A variety of feed should always be provided, not using any one entirely. Very weedy pasture, wood lots and the "range," and most wild uncultivated grasses are fatal to the best butter. So, too, are musty hay, poor grain, etc. Good wholesome feed; sweet and sound must be used. It is unpardonable to use up the half spoiled stuff to feed the butter cow.

Having good cows and proper feed and water, it becomes next necessary to provide good comfortable quarters. Some protection from the blazing sun of mid-summer should be had. A good *warm* barn with clean stalls or stanchions for winter is indispensable. The cows when in winter quarters should be kept *clean* with good clean beds to lay on. The offal must be promptly removed. No large manure heaps must be allowed to accumulate close to the stables to fill them with foul and loathsome odors. Pure air they must have to breathe. In fact, we will say now once for all, that from the very beginning, from the cows person, feed, water and quarters, to the very end where the completed product is placed in the consumers hand, the most scrupulous cleanliness must be observed. Omit this in any particular, and the balance of the labor will be in vain.

The milking should be done regularly, quickly and thoroughly. To be able to do this it is necessary to have the good will of the cow. The method so often seen in the west, of milking with one hand into a tin cup with the pail set twenty feet off to avoid the cows kick, will never do. With kind treatment a cow will not kick. They should never be struck, dogged-driven up to milk with full udders on a run or abused

in any way. A cow under great excitement, and all heated up with exertion and fear, cannot give good milk.

Having now the milk from good cows, well fed and watered, and drawn into clean vessels, the work is more than half accomplished. The butter may now be said to be in the makers' hands, and of the very best quality; there remains but to separate it from the balance of the milk and prepare it for market. This requires carefulness more than anything else, and with it success is sure.

The first step is setting the milk. This should be done promptly after milking. It must be done in a suitable place, free from strong light, and absolutely free from all odors, however slight, in a pure, dry and cool atmosphere. Two systems are in use, shallow and deep-setting. The milk may be set in shallow pans two or three inches deep. At this depth the milk should be kept at about sixty-two degrees. If much warmer the quality will be poor and the quantity less. It may be colder without damage to quality, but all the cream will not rise. It is important in setting shallow to keep the temperature uniform. As soon as the milk begins to turn, it must be skimmed. If the milk is allowed to get quite sour before skimming, sour and poor butter will be the inevitable result. When the quantity of cream is sufficient it should be churned every day. If not, care must be taken that the cream is kept cool and not allowed to get too sour. Many practice skimming and churning sweet-cream. This method undoubtedly will make the sweetest and most delicate flavored butter, but should only be practiced where the butter can be marketed immediately and consumed at once. Sweet-cream butter will not keep well. The acid must be allowed to work a trifle to ripen the cream before churning, to make butter which will keep well. There is scarcely a perceptible difference in flavor, and many prefer it, as it has more odor or bouquet. Where springs or cold water can be had to set the milk in during hot weather, they will be found the most convenient for holding the milk at a proper temperature. In setting shallow, it will save much labor to have large pans, one of which hold a milking. If the number of cows is too large for this, pans holding forty gallons at least can be used.

Where ice can be had in abundance, at a moderate expense, deep-setting may be used to advantage. The best manner of setting deep is by what is known as Hardin's method of making butter. This consists of setting the milk in an ice-chest, manufactured by Mr. L. S. Hardin, of Louisville, Kentucky. The milk is strained into cylindrical cans, eight inches in diameter, by twenty inches deep. These cans have a tight cover, and are placed in a chest divided by a shelf into two parts. The milk is placed in the lower part, and sufficient ice is put into the upper part to lower the temperature to at least forty-nine degrees; but a lower one will do no harm. In thirty-six hours all the cream will have risen. It is then skimmed, and the cream set into a separate can in the chest, or churned at once, as may be desired. If it is not desired to make sweet-cream butter, it must be allowed to stand in a warm place to get slightly sour. This method has many advantages, and will prove a great boon to those who make only a small amount of butter, or have no cool springs or wells to furnish water to set milk in by the shallow system. The milk is kept excluded from the air and all odors, hence no spring-house nor dairy-room is necessary. The chest may be kept almost anywhere it is convenient. In cold weather it may be kept in a warm room, and no fire is needed to keep the milk at the proper temperature, so long as the milk is not allowed to freeze. The milk is skimmed sweet and can be used for many purposes that sour milk could not. For all those who do not make enough to go to the expense of a regular dairy building, it is a cheap and most excellent method, and will insure good butter.

There has been much controversy about which method will give the largest yield. The truth is, that all the butter can be got by either, if set under the proper conditions. When milk is cooling, the cream globules do not cool, and contract as rapidly as the balance of the milk. They are, therefore, during that time, lighter than usual, and rise much faster. When set in deep cans, in a place of low temperature, the milk is a long time cooling, and the cream having the advantage of rising more rapidly than usual, for a long period, thus overcomes the increased depth; but if milk is set deep, in a high temperature, the advantage of a falling one is lost, and the cream cannot all rise before it sours. Again, when milk is not shallow, in a place of low temperature, being spread out over a broad, flat surface, it cools very quickly, and the advantage of a falling temperature is of very short duration; and when milk is cold, and the temperature steady, the cold retards the rising of the cream, and, hence, it will not all get up; but when set shallow, at a warmer temperature of, say sixty to sixty-five degrees, it all will rise.

The churning should be done at a temperature of about fifty-eight degrees in summer and sixty-three in winter. An old-fashioned dash churn, or the square revolving box churn, are as good as any. Churning must not be done too rapidly, and the numerous patent churns which do the work exceedingly fast, injure the butter by smashing the butter globules and injuring the grain, making the butter soft and sticky. When the butter is properly churned, it will gather easily in firm lumps. No water should be put in the churn during churning, either to warm or cool it. If not of proper temperature, it should be remedied by some other method.

After churning, the butter should be worked until free from buttermilk. This should be done on a wooden or marble table, with wooden implements. All wood coming in contact with butter should be kept thoroughly saturated with brine, or it will stick. The butter should be poured into a thin sheet, and the buttermilk absorbed with a cloth or sponge. In working it, care must be taken not to make a drawing motion with the implements; all should be done by pressing. Drawing anything over butter injures the grain, and makes it soft, smeary and sticky. The human hand should never touch the butter, as its warmth injures the grain. To make the best butter, no water should be used in washing the buttermilk out. Butter contains a number of volatile oils in very small quantities. It is these which give good, fresh-made butter that odor of fragrance which is so grateful to the epicure, and the absence of which will injure the selling, even though sweet and sound. Water washes out much of these oils, and a portion of the bouquet is lost.

After the buttermilk is out, it should be salted with either *Ashton's* Liverpool salt or the Onondaga Factory-filled Dairy Salt, made at Syracuse, New York. No other kinds of salt are pure enough, and, if used, will surely be detected, and the price lowered in consequence. Three-fourths of an ounce to the pound of butter is the best quantity, but it must never be over one ounce. Butter over-salted, and with coarse salt, or that which gives butter a fishy flavor, as many kinds do, will sell from ten to twenty cents less per pound in our city markets than it would if properly salted, even though perfect in every other respect. The salt must be distributed evenly through the butter, and then it should be set away until the following day, when it receives the second working, in the same manner as the first. It should be worked until the brine is clear in color, and the marbly appearance, which butter has when the salt has not penetrated all parts, has disappeared. Care should be taken not to over-work.

It should now be packed in a new, bright, white ash or oak butter-tub or firkin, which should be soaked in strong brine for twenty-four hours previous. The kind of package used to market butter in is very important. Jars are an abomination; they are fragile, heavy, and can have no tight covers, and add very much to the cost of freight.

No wood but white ash or oak is suitable. No second-handed package should be used. There is no economy in cheap cooperage ; get the very best, and, if possible, exactly the same as that used in the best dairy regions. Butter is often effected ten cents a pound by the cooperage alone. Buyers in cities are familiar with the packages used in different sections. If they see butter in poor or coarse cooperage, indicating that it came from a section where good butter is seldom made, they prejudice it, and even when they know it to be good, will insist on a reduction in price, because they know that a large proportion of the consumers mistrust their own judgment, and will not buy an article which they know comes from a section noted for poor butter. The butter should be packed immediately after the second working ; should be pressed down close, leaving no air-holes, and close to the sides. When there is not enough to fill the package, it should be covered with brine until the next churning is ready. The layer should be smooth and even on top. *No salt should ever* be put between the layers, nor around the sides, nor on the bottom of the package. When filled to within one-half of an inch of the top of the tub, it should be smoothed, but withdrawing the ladle, and covered with a *new* piece of cotton cloth, cut round to fit the package, and from which the sizing has been washed. Cover this with a layer of the same salt used in the butter, and moisten it with brine ; then fasten on the cover, and it is ready for market. Where a home market is at hand, butter can be marketed in rolls in very attractive style, after the fashion of the famous Philadelphia roll-butter, which brings one dollar per pound.

There are many portions of Missouri which are watered with fine springs and streams, and where grass will do well, which are most admirably adapted to butter-making. Many of these sections, too, are called among the poorest farming lands in the State, because they are hilly, stony, and not well adapted to compete with the fertile prairies in grain-raising. With proper cultivation, these same hills would make excellent pastures. The climate, too, of Missouri is better adapted to it. Our winters are much milder, grain is cheaper and less of it required. Cows can be turned on the pasture six weeks earlier in the spring and kept there a month or more later in the fall. Butter can be produced of as good quality, and cheaper, than it can in the most favored portions of New York. A market is at our very doors, and there is no good reason why it should not be made profitable and success attend the dairyman, even better than in his famous eastern home.

# DAIRY INTERESTS FOR MISSOURI AND THE WEST—THE DAIRY COW.

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BY E. A. FILLEY, Esq., ST. LOUIS.

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Much has been written and much more remains to be written, touching this subject, in which we of Missouri and adjoining Western States are largely interested, by which facts relative to the supply and demand for butter and cheese; also, the needs which exist for a better kind of each to meet the demands of our cities and towns. It is safe to say that fully three-fourths of our supply of butter and cheese are now brought to us from Wisconsin, Iowa, Illinois and Ohio and Michigan; also, from the dairy regions of New York State; also, Vermont and New Hampshire. This can be reduced to a great extent and well.nigh wholly prevented, if proper care and pains are taken to select farms for the dairy where a good supply of fresh, living water abounds, with *which*, and the proper observance of the laws of cleanliness, no reason should exist for our not doing so. Nothing is more sensitive to impurities, or taints, than milk, when set for its cream. We have, in our State, large sections that seem beautifully adapted to this interest. Counties like Washington, Jefferson, Franklin, also, large portions of Southwest Missouri, which is rolling and hilly, abounding in good springs, "*hill-side*," pasturing, affording short and sweet feed, which is always the best for this purpose, seems adapted to this interest, and can be profitably used. The *prices* which choice dairies secure for their *butter*, when neatly and properly brought into our city, must satisfy any one on this point, and must pay as largely as any other farming product in our State. There is one fact which cannot be overlooked in connection with the above, and that is one of *labor*; and we of Missouri should not be unwilling to do with hands and hearts as cheerfully as those in the States from whom we are receiving our present wants. It is useless to enter into any detailed statement as to the receipts into our State of the dairy product from abroad and its value. What we should do is to prevent it as much as possible, and to become our own *producers*. We have *location*, "*soil*," "*water*," and we *can* and should have in our State its *dairying* section as well known as "Orange county," New York, Northern Illinois, or Northern Ohio. Important to this interest, and one which aids it and gives it the right direction at the start, is the selection of the proper animals for *the dairy*, and such breeds as stand first and are *rightfully* and *truthfully* known to possess the greatest value for this *want*. The writer does not propose to open any door for discussion on this *point* with those who may choose to differ, but has no hesitancy in saying that no breed of

cattle at this day can be found in our country to which the distinction belongs and is so justly entitled to as are the "*Jersey cattle*." They produce more and better *butter* from a given amount of *milk*, always *yellow*, of a better flavor, and will bring an increased price *wherever* known or introduced. The reputation of the Jersey cow as a *butter animal* is established, and the present demand for them in Texas, and other Southern States, is a very encouraging sign, and will lead to good results in the dairy interest among them.

Wherever the *Jersey* cow has been introduced in the dairy regions, she has never lost her reputation as the very best type of her *species* for this purpose. Any statement, in detail, of the product of the Jersey cow, compared with other breeds, is not in this instance required—it has become an established fact that she has no superior as a dairy animal. If any doubts exist as to the increase, or the present standing of the Jerseys in our own country, the last show of them at the Centennial during the last of September, where they were on exhibition, would satisfy such doubts—the Jerseys outnumbering any other breed nearly *three to one*. The same ratio exists at nearly all the fairs in the eastern section of our country. We, of *Missouri*, are making good progress in this direction, and it is to be hoped that the good sense of the directory of our State and county, also, the St. Louis fair, will place the premiums on Jerseys on an *equal* footing with the Short-Horns, which were in no sense their superiors, nor are they in any way entitled to any increase of premiums; they stand in opposite directions, one for their milk and butter, the other for *flesh*. Much has been said and written upon the Jersey relative to *colors* and distinctive marks, which are in the main fancy points, *such* as black tongue, black switch, etc. Good and medium animals are found with each, as also in colors. Many prefer *solid* to mixed colors. As a race of cattle, they abound in each, and each breeder must exercise his or their own judgment in the *rearing* of his herd, not losing sight, however, of quality and quantity for *color*. We hope in a few years to have an exhibition of Jerseys in our State which will not be overshadowed by any in the older sections of our country. We are having in St. Louis, Jefferson, Pike and Ste. Genevieve counties of our State, a *good beginning*, which will bring about such results, and we can but hope to see in a few years that our dairy interests in Missouri may be elevated by the introduction of the *Jersey cow*, and the large supply of butter and cheese now sent here from other States may be reduced, and such portions of our State as are adapted to the dairy interests will speedily become productive and profitable in the making and sale of good butter, as dairying is not unprofitable, and choice well made butter and cheese will always find a market and good prices among our cities and towns. If any evidence is needed, compare the prices obtained in New York City, Philadelphia and Boston, where Jersey butter is supplied to hotels and private families at the cost of 75 cents to \$1, and in some instances at \$1.25 per pound.

The dairy interest of the West needs our protection, and it is a satisfaction to know that the award of the first premium was given to *Iowa* for the best butter at the late Centennial Exhibition. That there is not a need for the *dairy* interest to be enlarged and have a place in our State and counties, none can deny; all that seems necessary is to secure *proper locations*, *proper animals*, *suitable* houses in which the work required to be done can be easily and readily disposed of, and with this injunction ever in *mind*, that *next to Godliness is cleanliness*, no reason can exist why success will not follow any one who will begin.

There are many ways in which the product of the dairy may be handled in bringing it to city markets. Butter put up in one pound and one-half pound prints is most



attractive, having some neat impress. This adds to the *appearance*, and aids the sale, and can be *recommended*.

The value of the dairy interest in our country is but little understood. From late statistics, the estimated number of cows in the United States is 18,000,000; the yearly product, in round figures, of milk, butter and cheese, about \$800,000,000. Our dairy exports for 1875 were \$14,000,000. These figures give us good proof of the value placed on dairy interest, and the needs of this branch of our agricultural interest in Missouri and the West, to be enlarged, as we of Missouri have such natural advantages to commence the work so much needed to built up our home interests, and *thereby render us less dependent on other States for our wants of the dairy.*

Of the Jersey cow for the family and dairy more can be said; but it may not be out of place to give her value as a cow, and her yield of *butter*. We find on record numerous instances where she has produced from fourteen to seventeen and a half pounds of butter per week, and where one pound of butter has been produced from the setting of four and six quarts of milk. The richness of the milk is *proverbial*, no coloring material being required to make butter *yellow at any season of the year*. Consuming less food than most of the other breeds, she is destined to remain the most valuable of *animals* for the family and dairy that is in our land, and her increased value will become more and more *known* as she is introduced, and but few years will elapse before we will be able, by judicious breeding, to show the world that we have in this country as choice specimens as ever were imported from the Island of Jersey. It is but a short time since they were introduced, and they are yet, to a great extent, unknown in the Western and Southern States, as to their good qualities for the dairy.

Let us of Missouri keep on in this direction, for it is the right method to aid and disseminate what is good, by which others may see our good *works*, and follow in the spread of the dairy *interest*, and the proper animal for the benefit of this interest, and we shall attain results that will *crown us with success*, and be classed among the dairy *States*, and, we trust, one of the *best* in the land.

# PRACTICAL POULTRY-KEEPING.

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BY W. H. TODD, VERMILLION, OHIO.

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Notwithstanding the wide-spread and lively interest in thoroughbred and fancy poultry, the only safe and certain foundation of success must be upon the practical basis. If the breeder of pure breeds manages so as to make his business pay for practical purposes—for meat and eggs—no disaster can follow if he fails to find customers for his surplus stock at *fancy* prices.

That management which renders poultry profitable from a practical stand-point, as a general thing, produces the finest birds for fancy and exhibition purposes—that is, it is supposed to be such as to keep fowls in the best conditions of health and thrift. In order to do this, a knowledge of their wants and proper sanitary condition is necessary. In many sections, the scourge called cholera prevails with such disastrous results as to debar many from keeping poultry at all. We are of the opinion that, with the present light upon its causes, prevention and cure, it may be averted, and is within the poulterer's control. Our highest authorities and most thorough investigators agree that this disease is a "blood poison," caused by malarial or miasmatic atmospheric agents. The remedies and preventives indicated, then, are such as will neutralize the poisons in the blood, tone the system to render it more impervious to morbid and endemic influences, and also destroy malarial and epidemic poisons in the atmosphere. Proper dietary and hygienic measures must also be observed in housing in dry, well-ventilated quarters, kept scrupulously clean and frequently whitewashed with fresh lime whitewash, to which has been added a weak solution of carbolic acid. Diseased quarters should be saturated daily with a solution of carbolic acid.

Fowls need pure water for drink, with a good variety of grain, vegetable and meat food, cooked and uncooked, and a constant supply of ground bone and broken oyster shells. Constant access should also be given to broken charcoal. The best results are secured by housing in small flocks of ten to twenty-five birds. A room eight feet square will accommodate ten large or fifteen small hens. Houses may be built to divide in two or three compartments; but it is not best to keep too many under one roof. No more fowls should be kept on a piece of ground than to keep the grass fresh. Grass runs are essential to keeping in good condition. If flocks can be accommodated to a wide range, it is all the better for them. The nearer we can conform to the natural requirements of fowls the more likely we will be to succeed. Their natural habits and wants should be carefully studied.

One of the primal sources of profit is egg-production, which pays best in winter in nearly every section. In many places, eggs are too cheap in summer to pay, unless pickled. A very good recipe for preserving eggs is made as follows: To four gallons of boiling water add half a peck of new lime, stirring well for a while; when cold, run through a coarse sieve to remove any hard lumps; add ten ounces of salt and three ounces of cream of tartar, and mix the whole thoroughly. The mixture should stand two weeks before using. The eggs should be packed as closely as possible, and kept closely covered in the pickle. Every egg should be perfectly fresh before pickling. This preparation will preserve them over a year, if kept in a cool cellar.

Another source of profit is in raising "broilers," or early chicks in the spring for market. These are slaughtered or sent to market at six to eight weeks old. In Eastern cities they sell for thirty to fifty cents per pound, and their raising might prove very profitable, if carried on systematically to any extent.

Another profitable branch of the poultry business is to grow fowls for meat. This is profitable in nearly every section, with the present facilities for sending to market when dressed, by express. For New York, the best way to dress any chickens or turkeys is to dry pick—that is, to suspend by the feet and bleed by an incision well back and across the roof of the mouth, with a sharp knife, beginning to pick as soon as the fowl dies, and finish while warm. All the feathers should be plucked without tearing, leaving only the neck hackle, wing and tail quills not picked. This is the style preferred for that market. Heads and feet may be left on, and none of the insides taken out.

In order to ship and keep well, all dressed poultry should be well cooled through before packing. It can be best packed in boxes that will contain one to two cwt. A thin layer of clean straw should be placed above, below and between each layer of poultry. The cover must be pressed on solid to prevent the fowls moving about and getting bruised and chaffed. A difference of five to ten cents a pound is frequently obtained by taking pains and putting dressed poultry in fine order.

Now as to the most profitable breeds: The farmer may pertinently ask, "What is the use of 'blooded' poultry to me?" If allowed the care, or rather want of care, that some farmers give, the breed don't make much difference; one will do about as well as another, or better still, for humanity's sake, none at all.

Where fowls are kept to shift for themselves with no feed, except what the promptings of hunger compel them to scratch for or obtain by following other animals, no water, except what the uncertainties of clouds and weather furnish, and no shelter, except the canopy above or the protecting lee of a friendly fence, straw-stack or apple tree—where fowls are thus treated—common stock even is too good, though in the wise provisions of "adapting means to ends," nature seems to have provided common fowls for some people to neglect. With good shelter and good management, without overstocking, it will pay the farmer to either keep pure breeds or crosses of Asiatics on common stock. The first cross will increase the size, some fifty per cent., without any perceptible difference in cost of feed, as a large fowl eats and is quiet, where a small bird, being more active, digests food more rapidly, and hence consumes more in proportion. At maturity we feed eight and ten pound birds no more than the smaller common fowls.

It is well for the farmer to note the difference in the prices between common and Asiatic fowls (when dressed) in the New York market. Fed in the same way and prepared in the same condition, the difference is five to ten cents per pound in favor of the large birds. Suppose a farmer should use a pure bred Brahma cock and raise fifty half-blood fowls for market, increasing the size, say two pounds a head, or one hundred

pounds on the lot, estimating that they average, ready for New York, six pounds each, or three hundred pounds, netting fifteen cents a pound, or forty-five dollars, while the same number of ordinary fowls would dress but, say two hundred pounds, and sell for only ten cents per pound or twenty dollars; for fifty birds, we have a net gain of twenty-five dollars in favor of the cross by increasing the size. Five dollars, or even ten dollars for a cock to produce such results is not a bad investment, and further improvement could still be made by another cross with large stock.

It may be asked, "Why not advise the farmer to get pure bloods to start with?" We would advise it if we thought the farmer would think he could afford it; but if the object is only to increase size and saleableness in market, obtaining them by crosses is less expensive. As regards pure large breeds, we will take, say Brahmas, and make a handsome profit on them when kept for practical purposes only.

A Brahma pullet will commence laying at about six months old, and if hatched in the spring and kept till twelve or fourteen months old, if not permitted to waste any time sitting, will have laid at least ten dozen of eggs, which at twenty-five cents a dozen would net two dollars and fifty cents. The hen could be sold for market at the beginning of summer, when there is a scarcity of poultry, for about one dollar, making three dollars and fifty cents for one hen, which has not cost to exceed one dollar and fifty cents, leaving a net profit of two dollars; but lest some may think our figures high, we will say that one dollar and seventy-five cents, or one hundred per cent., is a pretty fair profit. The fertilizer product will offset the labor attending, etc. Cockerels, if kept by themselves and fed high till the following spring, will dress ten pounds, ready for the New York market. That is for this market they are only plucked and bled with a waste of about a half a pound to the bird. For this class of fowls the average price is twenty cents per pound in the spring, and netting fifty cents to one dollar each. These estimates are no "milk maid's air-castle building and counting chickens before they are hatched," but the results of our own experience, and what we have seen done by others time and again.

We should classify the best breeds for fowls and eggs in their order as follows: Dark and Light Brahmas, Partridge, Buff, White and Black Cochins; for size, eggs, and all purposes, with early maturity, Plymouth Rocks, Black Cochins, and Dorkings; the latter we don't recommend for this climate, as they are too liable to disease. For eggs, we should place non-setters at the head of the list: should say Leghorns, Houdans, Hamburgs and Spanish; of course where non-setters are kept, it is necessary to keep a few Cochin or Brahma hens to perform maternal duties.

For whatever purpose we keep fowls, it is best to so keep them that they will be a source of profit rather than a bill of expense.

When breeding for fancy, a handsome profit can be realized in the production of eggs, and the cull stock for the table and market. Respecting the number of breeds, it is best to keep no more than we can keep well and have room for. We are not of those who believe no person capable of keeping but one breed and making a specialty of it. We do believe that one breed is all a great many people should keep, and more too, while there are others who can keep a large variety and breed them all well. We hold there is no limit to man's capacity to acquire knowledge and develop the mind in any given direction. That with ample room, where poultry breeding is made the sole business and study, no one breed will satisfy the desires or gratify the tastes of a mind large and active.

# MIDDLE-MEN.

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BY WM. CAM.

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I use the term to designate all who live by buying, selling or transporting, between the manufacturer and producer and the consumer. It is a subject upon which very much is said or written that has neither point nor force; because so many assertions are made concerning this much abused class, that have no foundation in fact, or those who make them are so inconsistent in themselves. How often have we heard the average granger, after declaiming against agents, middle-men, etc., turn round and play agent on his neighbor—perhaps a brother in his own Grange, and make \$20, or may be \$60, by selling for others, a reaper or threshing machine. Incident to trade and commerce, always has been, is, and always will be, the temporary ownership of commodities in transfer or exchange and transit, by those who are willing to risk their means and employ themselves in such enterprises. There always has been and always will be more or less change and fluctuation in prices, losses by storm or fire, or other unforeseen yet inevitable accidents, so that the profits of such transactions must be in proportion to the risks to which the life and money so employed is exposed. The greater the factory or larger the field; the less practicable or possible is it for the manufacturer or farmer to follow his wares, or his products to the various and distant market upon which they must often be simultaneously put, and it is better and safer for both to dispose of or sell to those who can attend to the transit and final sale, for their own interests become then the sureties for their own diligence and judgment. As to whether this class is useful or even necessary, is to ask whether trade or the multifarious operations of commerce are beneficial and necessary to mankind. It is not as to the place filled, but the manner in which it is filled, that we raise a question. When we see the avocation of one class become, under the general system in which it is followed, unremunerative, and those who follow it fly to other callings in order to get on in the world, we may safely look into legislation, and deep in legislation too, not only for cause but for the remedy also. The natural love of gain in man, coupled with the necessity of making a living, is a sufficient motive power for trade, while the desire of the many to share in its profits which would otherwise inure to the few, creates competition; but there is a point in numbers at which this effect is reversed, at which competition ceases and combination begins. This point is where the commercial class has become so numerous that the profits of trade will not support them, and, at the same time, allow room for them to compete with each other. Unvexed by adventitious legislation, the natural laws of production and trade, of demand and supply, will, of themselves, preserve the due equilibrium of the respective classes; but when we see people crowding, unduly, from one class into another, and especially from a primitive or fundamental class, into a secondary or dependent class, we may rely upon it that there is

something wrong in the laws of that community or country in which this phenomenon appears. We have arrived at this point—the error lies deep in our organic law, and there the remedy must be applied.

It does not follow that because a class has become so large that it is a burden upon others to support it, that it is proportionately dishonest, though from necessity it must be exorbitant. It is true everywhere, that necessity knows no law; and when men are reduced to necessity they are reduced, more or less, to a state of lawlessness, or at least a disregard of morality and the rules of integrity; but from the peculiar needs of the calling, this is, perhaps, less the case with those engaged in traffic than with any other class. This is quite the contrary of the popular opinion, but popular opinions are only average at the best, and are oftenest formed from what is superficially apparent than from what is real, or what a critical examination proves to be true. I am a farmer, raised as a farmer, and expect always to be a farmer, and bring up my sons to the same calling. I have often suffered by the dishonesty, and what seemed to me unreasonable charges of middle-men; but the longer I live and the more dispassionately I study mankind and their ways, the more does it appear that we are all too ready to make scape-goats of a single class for the sins and short comings—chargeable as much to others, or to all. And even this exorbitance, so often charged upon middle-men, comes through them rather than from them. The great cumbersome machine of government, the cost of legislation and the expense of the execution of law, for which the whole people of every class are responsible, is too often at the bottom of what appears to be the faults of a class. Bad laws and regulations affecting commerce have recoiled upon production, and agriculture, becoming comparatively unremunerative, millions of capital has been driven from the country into the city, and thousands of men have been driven or drawn after it into the street. Dollars that should have been put in farm tools, improvements or stock, were invested in bonds or deposited in banks for the use and convenience of traders, speculators and mere produce gamblers; and men who should have been plowing, sowing and reaping, were bulling and bearing and cornering the markets for every commodity, adopting every shift or temporary expedient that put money in their pockets, or rather that seemed likely to do so, but which oftener failed than served them. The weight of the support of the whole middle-man class falls where the support of all non-producing classes falls—directly upon the producing classes; and in addition to their weight, in the untoward condition of trade, and the necessities of self-preservation, they injured rather than aided, the producer. Hence, we so often hear complaints, more loud than wise, and more impelled by feeling than guided by reason.

So far as these general charges of dishonesty upon merchants and middle-men are concerned, much may be said upon both sides, and perhaps the less said upon either the better. A condition of things that produces general hardships, produces general discontent, dissatisfaction and irritation; and human nature finds it easier to condemn than to discriminate, or decide a mooted point nicely; but it would be better for my own class, in policy and right, to throw fewer stones. In the latter part of January, 1876, I shipped, at Claryville, Missouri, on the steamer John A. Scudder, a small drove of mules to New Orleans, consigning them to N. D. Wetmore, Western Grange Agent at that point, going down with and caring for the stock myself. The boat owners, among whom was the captain, belonged to that class of middle-men of whom we farmers especially complain; but after making allowance for the hardships and annoyances, over and above the cost and danger incident to river navigation, their charges were reasonable and their conduct not unfair. There was not the preparation for the transportation of live stock that is sold by weight, as fat cattle and sheep, there ought to have been,

and there was too much crowding when stock freight was plenty, or cotton freight in full supply; but still there was a general desire evinced to accommodate shippers, and further their interests. On the other hand the boatmen had to submit to the most unreasonable and vexatious charges, and all the outgrowths of the general system of indirect taxation, which allows corporations to tax trade at every step; though every cent of such taxation, with interest and surety for risks, etc., is ultimately transmitted, through transporter and shipper to the producer, and falls upon the land. The *Scudder* was a vessel of the largest class, and at St. Louis, where wharfage is charged by the tonnage, she paid \$65.00 every time she landed there. At way-landings, some times where a decent man would be ashamed to ask a boat to round to, she paid from \$2.00 to \$5.00, the same as other boats; at Memphis, \$20.00; at Cairo, \$17.10; Natchez, \$8.00; Vicksburg, \$10.00 and New Orleans, \$104.20. She made, on an average, twelve trips a year, at a cost each trip of \$300.00, in this way, or \$3,600.00 a year. To these we must add, as coming from the same source, yearly: For inspection of boat, \$107.85; licenses for captain, pilots, engineers and mates, \$10.00 each, and for second officers, \$5.00. These last charges are made in the way of securing the public against loss by unskillful officers and boatmen; but this being similar to the object of all law and regulation, should be paid for out of the public purse; the funds for which should be raised by taxing only those things upon which taxation ultimately falls.

Arriving at New Orleans, we found the Grange agent unprepared to handle livestock, except through the stablemen and local salesmen, so that in the end the patron fared no better than if he had consigned directly to outside commission stock men. The Grange agent was not sufficiently assured of the permanency of his office, nor of the custom of patrons, to justify the outlay for stables and stock-yards; and besides, self-constituted grange agents, speculators and sharpers acting as such, were plentiful, and divided the custom of those who should have combined and given their custom to one properly authorized, so as to justify full preparation and outlay on their behalf. Every commission or sale stable in the city, so far as I could learn, was engaged in "bush-whacking," or speculating upon their own consignments. Stock received was retired in the stable, and fed at a rate that soon left no margin for profit, and even made into first cost, till the shipper, in despair, sold out to the stableman, or some of his cappers, at a sacrifice. Not a single farmer or shipper, who was not himself a stableman, made money in New Orleans last year on horses or mules, that I heard of. Sitting one day in one of the largest stables in the city, a patron and farmer from Kentucky called my attention to a party of gentlemen, who had called to look at and purchase plantation stock, and who were at once taken in tow by the stablemen. "There," said he, "watch the manoeuvres, and you will see that even if those buyers do not take any of the stock belonging to the stable, they will be allowed to leave without even seeing the stock that I, or any other shipper has here." And so it was. This we found to be a common practice, and the jockeys had agreed to the old trick: "You scratch my back, and I'll scratch yours." It is hardly fair to give this experience as a sample of the conduct of middle-men in general, for "jockey" is only another term for swindler and sharper, and New Orleans is not the only city in which these tricks are not commonly practiced. The horse may be a noble animal, but he has a queer influence upon the moral natures of those who make a business of buying, selling and trading him. But I have not done with my trip. By the advice of our agent, I took my stock from the boat to the cars, and having obtained through him a greatly reduced rate by rail, I corralled them on his farm near Ponchatoula, where I found a good temporary home in his family, and my stock was fed at just half the price charged in the city; though feed and forage was purchased there, and shipped per schooner via the canal, lake Ponchartrain, Pass Mau-

chac, Lake Maurepas, the Amite and Ponchatoula rivers to Wadesborough, one mile from the farm. While feeding them here I got an insight into the tricks of some who were not middle-men. The honest (?) farmer who had baled my hay, had carefully put all the bad in the middle of the bale, so it could not offend eye or nose by being noticed till the bale was cut open. Much of the oats and corn had been damaged in transporting; but some showed conclusively a not very laudable desire to put on the market an article that had more bulk and weight than worth.

It is not the general dishonesty of middle-men, as compared with farmers and producers, that we have any right to complain of; for, though they have more and better opportunities of cheating, they use them as seldom. Indeed, if any merchant or dealer should take the mere say-so of those who grow and market grain, grass or cotton, as to the quality and quantity delivered, they would soon be swamped. No, this middle-man nuisance, as we ignorantly term it, arises out of the general condition of trade in the country, and there are a variety of causes for the burdens we complain of, and lay to their charge as a class. As Wendell Phillips so aptly observed: "Economy with us is a skulking virtue." When we travel we have no use for second or third class cars, or cabins; and we are so afraid of being thought poor, that we keep ourselves poor by our silly sacrifices to vanity. We have no cheap, yet decent and substantial hotels in our cities, because, when the veriest clod-hopper goes to the city, he is above such things; and it is almost impossible in our cities to do anything cheaply, for the added and multiplied burdens of government, municipal, State and National, press and bear everywhere and upon everything. We may seek to improve our methods by the special education sought in granges and farmers' clubs, and we may, by combining, buy cheaper and better than we now do; but the relief thus obtained can only be partial and temporary; for over and above all, the general condition of the country will, like the horizon, still hem us in. Every evil or excrescence that afflicts our social and public life has its root in the organic laws that lie at the foundation of the State, and can only be eradicated by going back to those laws and correcting them. Others may differ with me, but I would go back to the fundamental laws of this nation and strike out every word that under any pretense throws even the shadow of an artificial trammel upon commerce, or that in the slightest degree hampers the freedom of disposing of to the best honest advantage on the world's markets the product of the soil, or the labor that tills it.

For all revenue I would fix all taxation directly upon the objects or subjects upon which taxation ultimately falls; and these subjects can be much more nearly and clearly seen and determined than many political economists would have us believe. Such a plan, says the student of American political history, would be incompatible with our form of government, and it would make the general government a fifth wheel, without any permanent means of support, as it was under Jefferson's Constitution of 1781; or you would have to obliterate State governments and lines, and establish a consolidated or centralized republic. Be it so, I would willingly sacrifice State governments and lines for the interests and liberties of the people; and instead of supporting forty sovereigns be satisfied with one.

It would not be pertinent here, had I time, space and inclination, to go further in this direction, but the manner in which our dual, or rather *multiple* form of government affects taxation and commerce, is well worthy of a thousand times more attention than it receives, especially from farmers; and it would seem, by all odds, better that we should make any change, however great and radical, than struggle under a self-imposed oppression that is a negation of all good government.

I cannot close this article without giving copious extracts from a speech delivered



at the opening of the new Merchants' Exchange in St. Louis last winter by Capt. Jas. B. Eads, who has studied these questions to better advantage than I have been able to do, and who says more in one short speech than I could in volumes. This speech was well received at its delivery, but has since not received the notice due, especially by the public prints :

"It hath been said that he who causes two blades of grass to grow where but one existed, is a public benefactor ; but I tell you here, that he who removes the barriers that exist between the producer and consumer, and who lessens the cost and embarrassments that attend the interchange of the productions of labor, is worthy of the highest honors of the State. These are the grand problems which commerce keeps constantly before the enlightened merchant. Every step in their solution raises the value of the products of human industry, even before they leave the farm, the mine, the workshop, or the factory. This stimulates production and increases traffic. Therefore, the destruction of every obstacle existing between the producer and the consumer, whether it be a natural or artificial one, is fraught with triple blessing to mankind.

He who daily seeks the market place for trade and barter, and who never ponders over the cognate questions involved in bringing the producer and consumer into closer relationship, and in freeing traffic from the trammels which legislative demagoguery, selfishness, or misdirected patriotism have thrown around it, is but a simple drudge in the train of commerce, and is unworthy of the high title of merchant.

The solution of these questions should be the constant study of the true and enlightened votaries of commerce—her merchant statesmen, her merchant princes. Merchants like these elevate humanity. They leave the impress of their practical wisdom upon the destinies of the State, and the monuments of their genius and liberality stand like beacon-lights in after times, to cheer mankind onward in its grand march of improvement. Such men enlarge the area of civilization, refinement and constitutional liberty, and the highest honors which man confers upon his fellow-man are within their easy grasp.

\* \* \* \* \*

Returning to the great problems which commerce presents for solution to her intelligent followers, these are all contained in the one comprehensive question : How can the easiest interchange of the productions of human industry be accomplished ?

No intelligent man will deny that in proportion as the interchange of products is facilitated, there will be, first, increased value given to them while they are still in the possession of the producer ; second, that production will be stimulated, by which commerce will be benefited and reap larger aggregate profits ; third, that while the producer will be better rewarded, and the sphere and profits of commerce enlarged, the increase of production and facilities of trade will inevitably reduce the price of these products to the consumer. It is, therefore, evident—as these three classes, namely, the producing, commercial and consuming ones, embrace the entire population of the State—that every man, woman and child in the nation, unless favored above the rest by some special legislation or individual advantage, is directly interested in freeing trade from every trammel and impediment, whether natural or artificial. [Applause.]

As there is scarcely a civilized nation to-day on the face of the globe where trade is so much hampered by natural and artificial difficulties as it is in our own, this broad question, how can we facilitate trade? is one that should override every political, social or religious question in the land—for this one affects the wages of the laborer and the rewards of the industry of every man and woman in the Republic. It is a

question of national wealth or national poverty, and the poverty side of the question is pressing so closely upon the people at this moment, and all over the land, that it must be promptly met.

To facilitate trade two great agencies are absolutely requisite. One relates to the conveyance of the property to market, and the other to the equivalent to be received in exchange for it. These are known by the general terms, transportation and finance, and they are so inseparable in all mercantile transactions that the first may be not inaptly termed the bone and sinew, and the last the nerve and brain of commerce. They are, indeed, the chief handmaidens of commercial wealth, and the simplicity of the principles governing the seemingly complicated functions of each, and the harmony with which their actions respond to the ever varying impulses of commerce, possess for the enlightened merchant who fully comprehends them, the charm of philosophy and the rhythm of poetry.

The key-note of our national prosperity is sounded in the simple words, "Cheap transportation." They should be stamped upon the stripes of our national banner, and thrown to the breeze from every farm house, mill and factory throughout the commonwealth. Schoolboys should be taught that the superior facilities for cheap transportation secured to Phœnicia, Athens, Venice, Genoa, the Florentine Republic, and Holland, the commerce of the world. Each retained it until its rival became the cheaper carrier; and, it is a notable fact, that art, refinement, literature, history and eloquence attained in each State its highest development during their commercial sway.

When we examine the relations of finance to commerce, it must appear evident to every disinterested thinker, that its proper functions cannot be performed perfectly, except on the basis of a medium of exchange that is recognized in every quarter of the commercial world. Gold and silver constitute the only medium thus universally recognized. An early resumption of specie payment is therefore essential to the restoration of our commercial prosperity.

The great historian, Hume, pungently remarks: "What a pity Lycurgus did not think of paper credit when he wanted to banish gold and silver from Sparta. It would have served his purpose better than the lumps of iron he used as money, and would also have prevented more effectually all commerce with strangers as being of so much less real and intrinsic value." There is a volume of wisdom in this paragraph.

Paper money is the resort of nations when in desperate straits, and unless managed with extreme caution, inevitably results in disaster to commerce.

But there are other absolute requisites to the commercial prosperity of America, scarcely less important than cheap transportation, and probably of more moment than a sound national currency. I refer to the legislative trammels which to-day embarrass almost every department of commerce in America.

While it is not denied by any one that cheap transportation is absolutely essential to our national prosperity, and while the most enlightened nations of the earth—England, France, Holland, Belgium and Germany—witness, by their great prosperity, the advantage which flows from removing the trammels that cupidity or folly once placed upon their trade, we are actually erecting, in every part of the country, expensive structures to hamper and delay the traffic of our own people with foreign lands, as though it were possible to impose difficulties in the way of receiving their commodities, and not have these difficulties react to check the exportation of our own.

Tariffs are imposed which prevent us from purchasing in the cheapest markets of the world, and we are assured that the way to grow rich is to pay the highest prices for everything we consume, while not a tithe of the increase in price that is paid by

the people goes to support the Government, but to enrich, instead, a few monopolies.

Let commerce be free. Tax the wealth of the citizens by any just method, but do not interfere with his right to exchange, with absolute freedom, the products of his own labor for those of his fellow-men, for that is an inalienable right which God made so for a wise purpose. This right is the great, if not the only stimulus to surplus production, and surplus production constitutes the real wealth of the world. Tax wealth, but leave free the stimulus which creates it. [Applause.]

The right to liberty of person in man is no more sacred than his right to freely exchange the products of his labor, because the two are identical in principle, and you cannot invade the one without trespassing upon the other.

Then let commerce be free. Let it not be said that a great nation, claiming to be the home of liberty, and which has, at such terrible cost of blood and treasure, stricken off the shackles from the slave, hesitate now to disenthral the labor of freemen.

Let commerce be free as the genial sunlight, whose blessed rays warm alike the prince and the pauper, and which gild with their glory the palace and the cabin, and she will fill the mansion of the great with refinement and luxury, and the cot of the laborer with comfort and plenty.

While cheap transportation is vitally essential to commercial prosperity, we are expending more money annually in the erection of custom houses, to place artificial barriers in the way of commerce, than would be necessary to free the great rivers of this grand valley from their shoals and dangers forever.

Fifteen millions of dollars judiciously expended would give at least twelve feet of water all the year round from St. Louis to New Orleans. This would enrich America, and by opening to the commerce of the world the immense granary embraced in the giant arms of the Mississippi, would cheapen food and bless mankind, not only at home, but on distant shores, "as far as the breeze can bear the billows' foam."

Instead of expending this \$15,000,000 for this noble purpose, we see ten of it expended on a single granite pile in New York, and the remaining five will, in all probability, be exhausted in completing the custom-house in your own midst. The uses for which these costly edifices are designed is a reproach on the intelligence of the age. While the great want of the country is cheap transportation, our laws forbid our American ship-owner from purchasing his ships wherever he can buy the cheapest, and thus interfere with his supplying to his countrymen this great essential to our prosperity, and leave the carrying trade of America hopelessly in the hands of foreigners. One of England's most illustrious statesmen, justly declared: "Whosoever commands the sea commands the trade of the world. Whosoever commands the trade of the world commands the riches of the world, and consequently the world itself." With the splendid advantages which nature and American genius gave us to compete for the commerce of the world, we have the humiliation of knowing that to-day three-quarters of our own commerce upon the ocean is carried for us by foreigners.

How long must such lessons as these be thrust upon us before we can be taught wisdom; before we can abolish forever this mis-called policy of protection? How long must it be before we can throw open these prison houses of trade and let commerce be free. They are the promoters of sectional and social ill-will; the barriers to international amity; and the harbors of commercial leeches, where the smuggler and the perjurer holds the honest merchant at disadvantage.

Demand from your law-makers the abolition of custom-houses and the creation of a plain and just system of providing the requisite revenues of the State that shall leave commerce free. Do not be cajoled by the public patronage, which expends a few hundred thousand per annum in their erection, and which, by their blighting influ-

ence, deprives you of countless millions; but demand that this worse than waste of money be appropriated to deepen your great rivers, and construct canals necessary to join their tributaries with the ocean, and encourage the construction of your great transcontinental railways.

Let your ship-masters buy their ships where they find them cheapest, and float the stars and stripes above everything that belongs to your countrymen. Let commerce be free, and honest competition will soon solve the great problem of cheap transportation on land and sea.

Let commerce be free, and manufactures will then feel a healthful development, uninfluenced by the fear of altered tariffs. Her work-shops, mills and factories will then, more than ever, constitute the nursery from whence liberty in every land and age has called forth her sternest advocates of equal rights and genuine Democracy.

Let commerce be free, and the disenthralment of labor will be complete. Then will honest toil be truly dignified and honorable, and then will agriculture, once defiled in ages past, again be recognized as the guardian goddess of manly independence, and the shelter of every household virtue." [Applause.]

# GRAPES IN 1876.

BY GEORGE HUSSMANN, SEDALIA, MO.

The last season was an unusually trying one on grapes, for the early part of the season all varieties looked exceedingly promising, set fruit abundantly, and the vines started luxuriantly. But the wet weather during June and July frustrated the best hopes of our vineyardists throughout those sections of the State where grape-growing is followed most extensively. Rot and mildew, with all the diseases to which the grape seems to be subject, made their appearance, and where full and swelling bunches had set, they were soon reduced to solitary berries. Nearly all varieties suffered, but especially the Concord, which formerly was one of the healthiest, failed badly again, and now proved one of the most unreliable. I have been told that many vineyards in the valley of the lower Missouri and Mississippi were not even gathered by their owners. Goethe and Martha, although also rotting badly, fared better than Concord, and produced from one-fourth to half a crop. Massasoit and Lindley, also Wilder rotted badly. The Catawba, although not rotting as bad as Concord, lost all its leaves, Herbemont, Cunningham and Hermann, were affected by a sort of dry-rot or sun-scald, and lost nearly all their fruit. The same may be said of Rulander and Louisiana. Taylor also lost two-thirds of its crop. Among those which suffered least, I name the following:

*Ives*.—A pretty full crop and but little rot. It seems to be one of the hardiest; it may be that its skin is so thick and its quality so poor, that even the rot disdains to attack it. It is reliable, but would I not grow better grapes than *Ives*, I would quit altogether.

*Perkins*.—This, although very foxy and apt to drop from the bunch, may yet be valuable, as it is early, has a beautiful color, and will sell well in market.

*Nortons' Virginia*.—This old stand-by, although rotting slightly, yet produced a fine crop of exceedingly large and juicy berries and fine bunches.

*Cynthiana*.—The same, and as this latter makes a wine finer in flavor and more agreeable than *Nortons*, in fact the finest red wine which can be made here, it is surprising that it is not planted more extensively.

The *Elvira* has again proven one of the most reliable, and whoever has seen it as I did, in Mr. Rommell's vineyard, among the general destruction of nearly all varieties, averaging twenty to twenty-five pounds to the vine, of its solid lusters laying even on the ground, without hardly any rot, and has tested its exquisite wine, cannot help but

feel that a new era is dawning upon us, and that Mr. Rommell has at last found what we have been looking for in vain so long, a perfectly hardy, healthy white grape, good enough for the table, and making a fine white wine which can be produced always. But, good as the Elvira is, Mr. Rommell has still several seedlings which he thinks will come nearer perfection yet. These, however, have not been tried so long, and although they have withstood this and last seasons' test, he wishes to give them two further seasons' trial, and should they stand these without flinching, they will go out before the public.

The following are the most promising, and have received names, as they certainly deserve to be named :

*No. 5. Taylor Seedling. Transparent*—Bunch larger, more shouldered and compact than its parent, and has always set well; berry about the same as Taylor, white, transparent, with grey dots, no pulp, thin skin, very sweet, fine flavor. Will make a wine of the highest quality, and as it is a strong, healthy grower, and seems very productive, may be as near to the perfection of a white wine grape as we can hope to reach.

*No. 8. Taylor Seedling. Amber*—Strong, healthy grower, dark brown wood, bunch large, shouldered, moderately compact, berry medium, oblong, pale amber, when fully ripe, sweet, very juicy, fine flavor, pulp, melting thin skin, requires about same time as Catawba, and does not seem subject to mildew and rot. As this is larger than Elvira in bunch and berry, and very productive, it will make a very attractive table and market grape of the finest quality, and will also, no doubt, make a fine wine.

*No. 10. Taylor Seedling. Pearl*—Strong, healthy and stocky grower, large heavy leaf, bunch heavier than Elvira, berry full medium, round, pale, yellow, skin thin, pulp soft and melting, fine flavor, very sweet and juicy. Ripens with Concord, or a few days later.

*No. 12. Cross between Maxatanney and Delaware. Beauty*—Growth strong and healthy, large, heavy leaves, bunch full medium, shouldered, berry about like Catawba in color and size, fine lilac bloom, superior quality, sweet, soft pulp, very fine flavor, free from disease so far, ripens about same time with Concord.

It is remarkable that most of the promising new grapes in this State have sprung from Taylor Seedling. There is another, raised by Mr. William Wegdemeyer, at Hermann, and which he has named *Vehland*, which bids fair to rival the Elvira, and even excels it in weight of must. It has borne very heavy crops of fine perfect bunches for several seasons, and wine of the finest quality has been made of it. It is a longer jointed grower than Elvira, resembling its parent more in leaf and growth, but as the leaf is thinner than Elvira, it may not be able to withstand our changeable climate as well. It is certainly very promising, and I shall watch it with a great deal of interest.

It is certainly encouraging, that now, when the European varieties (*Vitis Vinifera*) are almost annihilated in France by the Phylloxera, and this insect also threatens to destroy the vineyards of all Europe and California, we are getting new accessions to our lists of hardy grapes, and that they should mostly come from the Cordifolia, (or Rytaria, as Dr. Engelmann has it), class, which also is Phylloxera proof, as the Taylor and Clinton have proven in France. It is not improbable, that our State is destined to furnish the stock by which the grape-growing interest of Europe and California will again be established, when their Vinifera succumb to this destructive insect. There can be little doubt that we must look to the Cordifolia and Aestivalls class for our leading wine grapes, and if the seedlings keep improving in size and beauty, as they have done within the last few years, also for our market and table grapes.

As to the causes of rot and mildew, it seems to be idle to speculate. We know this

much, that it generally follows excessive rain-fall, and a close, murky state of atmosphere. It is therefore reasonable to suppose that excessive moisture around the roots and among the foliage of the vine has a greatdeal to do with it. Thorough natural drainage will certainly act as a partial preventative. I was forcibly struck by a remark of a medical friend long years ago, "that we could hardly expect to grow healthy grape-vines where chills and fever prevailed," and have found it verified in almost every instance. Wherever and whenever malaria appears in abundance, there and then look out for disease in grape-vines. From this conclusion, it would follow, that our high table-lands, with their pure air, are more adapted to grape-culture, and the last season has certainly gone far to prove it; for, while the disease prevailed along the large water-courses, our vines here and in the neighboring counties were almost free from it, and have a fine crop of grapes of good quality. This was, however, also true around Kansas City and St. Joseph, near the Missouri river; but the soil there is much more sandy, and will drain better than at Boonville, Jefferson City and Hermann.

In making future plantations, we should, therefore—

- 1st. Plant only the healthiest and hardiest varieties, and of the best quality.
- 2d. Choose the most airy situation we can find, and prepare the ground well by deep and thorough tillage.
- 3d. Drain off the surface water.
- 4th. Never work the soil when it is wet, as this will induce rot.
- 5th. Distribute the vines well over the trellis, and train them as high as we conveniently can, to admit a free circulation of air.
- 6th. *Early* and close summer pruning, for the same reason.
- 7th. Not mutilate the foliage late in the season by the abominable cutting and slashing, for when the fruit is ripening it needs all the healthy foliage to elaborate the sap.

If we do all this, I believe that the grape is yet the most certain fruit we can grow—a fruit which everybody and his neighbor ought to have, and to plant, at least for their own use. With the material now at hand and in prospect, we can still hope to become a wine-producing State, and rival the nations of the earth.

# REPORT OF PROF. G. C. SWALLOW

ON THE

## AGRICULTURAL COLLEGE.

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November 15, 1876, at a meeting of the Faculty of the Agricultural College of the University of the State of Missouri, the attention of the body was called to a paper contained in the "Report of the Board of Agriculture" of the State for 1875, on pp. 252-255, and the subject was referred to a committee. The following paper is submitted as the report of that committee :

**MR. PRESIDENT:** The committee, to whom was referred the Eleventh Annual Report of the State Board of Agriculture (that of 1875), with special reference to a report (on pp. 252-255) of the committee of the Board sent to examine the condition of the Agricultural College of the State of Missouri, have examined said report, and submit the following statement :

We cannot but express our surprise that such a paper could emanate from a committee of the Board and be published by its sanction ; for it seems to be based upon an entire misapprehension of the *design*, *financial* condition of the Agricultural College, and of its *relations* to the University. Since the Board of Agriculture was an efficient actor in the sharp and protracted struggle over the location of the College ; since several of its members took very active parts, either as legislators or lobbyists, in shaping the laws which fixed its designs and functions, and established its relations to the University ; and since six members of the present Board, including its President, Vice-President, Treasurer and one member of this committee have been members of the Board of Curators—some a part, and one all of the time since the location of the College—and must have had a large influence in fixing its status in the University, shaping its policy, forming its Faculty and course of study, and furnishing its facilities for instruction, farm-work and experiments—since, in a word, the Board has done so much and so wisely for this College, of which its members were made the special guardians by the organic act, we feel surprised and grieved that they should publish a report so calculated to injure our Institution in its present crippled condition.

Your committee, therefore, under these extraordinary circumstances, believe it the duty of the Faculty of the Agricultural College to state, in definite terms, its *design*, *relations to the University and present condition*.



## I.

*The design of the Agricultural College is precisely what the report of the Board of Agriculture says it should be, viz. : to give professional instruction in agriculture, and not, as this report says (p. 252), "to teach all sorts of knowledge to everybody."*

The public sentiment of the country and of our own State for the last twenty-five years, has demanded an agricultural school, which should teach the sciences pertaining to agriculture, and illustrate their applications by the practical work of the farm. The whole history of the movement, which has resulted in so many of these schools, fully proves this.

The history of agricultural education shows that the cause originated with and received its chief support *prior* to the Congressional grant of 1862, from educated men, who were engaged in some of the departments of agriculture. Such men as Stephen Rensselaer, the prince of farmers, and Judge Buel, more popularly known in New York as "*Old Rutabago*," could not fail to give *practical character* to the cause they so ably and persistently advocated and built up.

The earliest schools established in our country for the purpose of giving instruction in agriculture, had no farms for making a practical application of the principles taught, but recognized the necessity of such practical applications by utilizing the operations of the neighboring farmers. With this design was founded the Agricultural Department of the Rensselaer Institute at Troy, New York, in 1824, the Department of Agricultural Chemistry, in Fredric County Academy, Maryland, in 1845, and the Agricultural Laboratory in Hampden Academy, Maine, in 1848.

The main object of these schools was to teach the sciences relating to agriculture, and to give such technical, practical or professional instruction as their means would permit. The leading *idea was to teach the Sciences in their technical relations to the Farm.*

But these schools did not meet the wants of the country, and were soon followed by others established as separate schools and on a more liberal basis. The public sentiment of the country demanded a *good general education, and the practical application of the principles taught in the lecture-room to the work of the farm.* Hence the Michigan Agricultural College opened in 1857, the Iowa Agricultural College in 1858, the Maryland and Pennsylvania Agricultural Colleges in 1859, and the College of Agriculture, at Onelda, New York, had courses of study designed to secure a general *High School* education in addition to the scientific and technical instruction and the practical applications on the farm.

They gave courses of instruction so eminently practical and satisfactory that they received the portions of the Congressional grant allotted to their respective States by the act of 1862. These agricultural colleges had farms for practical and experimental work; and the Agricultural Department of the University of Missouri, established in 1859, gave technical instruction illustrated by such practical work as could be made available on the neighboring estates.

It will thus appear that it was the design of the Agricultural Schools *prior* to the grant of 1862, to make skillful farmers by *teaching the sciences in their technical relations to farming, and by practical illustrations of the principles taught in the operations of the farm, in connection with a good High School education.*

The originators and enactors of the law of 1862 had no intention of curtailing the practical features of the industrial education already in successful operation, but rather to extend its influence and make it *more efficient* by establishing schools in all the States, and by giving funds for *permanent* endowments, and for such *additional* studies as would make the graduates of these improved industrial schools the peers of the graduates of other colleges in general culture, and the equals of farmers and mechanics in

manual skill. For the law clearly demands a thorough professional school, and permits the addition of the ordinary collegiate studies.

The terms of the act are definite on these points. The clause: "*Without excluding other scientific and classical studies,*" plainly admits the ordinary collegiate studies; and the clause: "*To teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the Legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life,*" as clearly demand a professional or technical college. And the practical feature is made absolutely certain by section five, which provides for the purchase of "experimental farms." If there were any doubt of the design of the law, the design of those who proposed it, and the members of Congress who introduced it and secured its passage, should aid in the interpretation.

Rev. Amos Brown, president of the People's College, N. Y., was sent to Washington in 1858, to see how Congress would receive a proposition to set apart a portion of the public domain for "*practical education.*" He found the Hon. Justin A. Morrill, chairman of the house committee on agriculture, disposed to second his efforts. The law of 1862 was the result of their joint action, aided by the friends of industrial education throughout the country. We know, from personal intercourse, it was the design of president Brown to make these schools thoroughly practical, as he had endeavoured to make those over which he had presided at Oneida and Havana, N. Y.

The speeches of Mr. Morrill, on his own bill, show clearly his design in proposing it. He says: "*The bill proposes to establish.*" (Ag. Rep. 1865, p. 122.)

This and other parts of his speeches show that his design was to give endowments for schools, which should give a "*liberal education,*" with special provisions for the sciences relating to agriculture and their practical application in the work of the farm, and where the "*sons of toil*" might find *free tuition* and opportunity to pay their expenses for board by work on the farm. He hoped thus to make possible the education of a large class of American youth, who would be better prepared to discharge their public duties.

In accordance with this interpretation, nearly all the States have provided colleges with farms and other apparatus, for making a full, practical application of the science taught to the work of the farmer. And all the schools which have no farms, and notably the Sheffield Scientific School of Yale College, have expressed a desire to possess lands for practical and experimental purposes. They recognize its necessity by saying, "*Many of the advantages \* \* \* may be secured by observations and experiments on private farms in the neighborhood of New Haven.*"

In our own State, the public sentiment from first to last, has clearly and persistently demanded a professional school, including farm-work. One of the earliest expressions of public sentiment on this question was an address of the farmers and mechanics of Boone county to the people of the State in 1852, calling for a united effort of all classes to improve the Agricultural and Mechanical Arts, by the formation of Agricultural and Mechanical Associations, and by a State Industrial School, "*where our sons may be thoroughly and practically taught all those sciences which pertain to Agricultural and Mechanical Arts.*"

This address was endorsed and reissued by the Farmers and Mechanics of St. Louis county; was published throughout the State, and led to our Agricultural and Mechanical Associations.

Soon after, the State Agricultural Society, under the lead of such men as Napton, Marmaduke, Hardiman, Elliot, Minor, Harris and Stephens, published several addresses advocating similar views, and sent a memorial to Congress asking for Congressional aid in the enterprise.

The people of St. Joseph and the Northwest, petitioned the Legislature in these strong terms: "*It is by means of Agricultural Schools and Colleges alone that farming can be rescued from its inferior position. \* \* \* \* \* It is by the application of true scientific principles in its processes, that it can elevate the farmer and increase his profits.*"

Many journals of the State were the persistent advocates of similar views. Most prominent among them were the *Western Journal and Civilian*, under Judge Tarrier, the *St. Louis Republican*, under Col. Chambers, and the *Missouri Statesman*, under Col. Switzler.

In 1859 the Faculty of the University of the State of Missouri asked the Curators to establish a school of "Scientific and Practical Agriculture." The School was at once opened with a large, enthusiastic class of sixteen, who continued their course of study until the University was remodelled by legislative action.

In later times, we find the records of the State Board of Agriculture, of the State and District Horticultural Societies, and our agricultural journals, full of the strongest expressions in favor of making the State Agricultural College *thoroughly practical*. In fact this Committee of the State Board, is perhaps the first to give public utterance to the idea that the Agricultural College may be simply scientific and technical, without practical illustrations in farm-work, and yet comply with the law creating it.

But the vigorous struggle over the location, whether it should be an independent school or a college of the University, intensified and crystalized the idea in the public mind that the school should be *professional*, with farm-work for practical illustrations. Those who demanded a separate college did so mainly through fear that if placed in the University its professional teaching and practical work would be overshadowed and neglected in the presence of the time-honored collegiate and professional schools, and the prejudices which professors and students were supposed to cherish toward these new toil-worn claimants for scholastic recognition and University honors. They also object because the professors of literary institutions \* \* \* \* \* have little knowledge of the work of the industrial classes, and no sympathy with hard workers. \* \* \* \* \* Whereas, the teacher who instructs pupils in the sciences which pertain to agriculture, should himself know what agricultural labor is, and be ready with practical applications on the soil to illustrate the laws he teaches." And besides, they insisted that he should not only know, but also love and honor the work. We quote from their address to the Legislature:

"We say put it (the Agricultural College) in the hands of live men, who are in sympathy with the progress of the age, and who know the wants of the farm and work-shops. We must have one man at least who will be in sympathy with and who will know the wants of the farmer and mechanic. He should know how to 'speed the plow,' and to unfold all the treasures of science; he should love the field and the forest, be at home in the orchard and the vineyard, and love the *shibboleth* of the herdsman and the shepherd."

They believed such teachers would inspire our youth with such a love of the farm and its noble work as would elevate them above the pleasures of the city and the ambitions of political life.

But the advocates of union, and most conspicuous among them, the President and Curators of our University, made the strongest possible declarations in favor of the technico-practical feature of the Industrial College. They indeed became the warmest and most zealous advocates of *experimental farms, fine stock, farm-houses, orchards, vineyards, gardens, plant-houses, work-shops, and all the appliances needed to make a first-class technico-practical school.*

President Read in his Inaugural Address, uses this definite language: "In our College of Agriculture we must have the solid foundation of science \* \* \* to be accompanied, it is true, \* \* \* by the test of experimental practice." In his exposition of the Congressional Law, he says: "The *term liberal*, as well as "*practical*," are expressly used as comprehending the objects aimed at in the education of the industrial classes in the pursuits and professions of life. "What right," he asked, "has any man to step forward and annul these grand provisions?"

President Read said to the Legislature in 1867: "The objection is too whimsical and absurd for serious reflection, that the Industrial Schools cannot flourish with professional and literary colleges. \* \* \* \* The Industrial must be made equal to the professional, and put side by side with them."

In his Commencement Address, 1868, President Read said, in speaking of the educational reform needed, it is proposed "to apply the highest science to the best methods of art, first the *liberal* and *scientific*, then the *practical*. First to *know*, then *do*." In Botany he would have the student "study the principles in the class-room," and "grow the plants and make the experiments" in the field.

He also drew a beautiful picture of an experimental farm, stretching away from our University a mile or more to the banks of the Hinkston, covered with buildings, orchards, "vineyards," "grain-fields," "every variety of farm implements," "gardens," "laid out with walks" and "furnished with hot-houses and conservatories," "rich in plants and flowers and shrubs" for the study of Botany, all for the experimental work and study of professor and student.

The Curators were no less emphatic in their interpretation of the law of Congress, that it demanded a technico-practical school, as shown in their memorials for the location of the Industrial College. In the memorial of 1867, they gave a somewhat detailed account of the princely domain attached to the Agricultural Institute at Hohenheim, with the lavish for giving the student every possible opportunity to gain manual skill, and make practical application of the sciences taught, in culture and management of forests, all kinds of farm crops, fruits and garden products, and in the rearing and management of all the varieties of domestic animals; and say this, "with such changes as the difference of society and government requires, may be assumed as a guide for our efforts."

In the memorial of 1869, they say the law of Congress demands "*practical training*," and the "*training of practical workers*."

When all parties were thus in accord on these fundamental and vital features of the prospective college, the law locating it was so formed as to place the practical features beyond all danger of being overshadowed or neglected. The law provides for a District College, "to promote the *liberal and practical education of the industrial classes in the several pursuits and professions of life*." Language can scarcely be more specific, respecting the practical features.

In answer to the question: "What shall be the aim and scope of the University, if the college agriculture were made a department?" the Curators say: "Our University must be brought up to the highest requirements of the times, and have all the means and appliances necessary for imparting a thorough and practical education to our young men who may wish to engage in the various pursuits and industries of life. \* \* \* The agricultural and mechanical arts must be placed in the same rank as the learned professions; then will young men crowd her halls, but never if we act otherwise."

This memorial also quotes approvingly estimates made by the trustees of the Massachusetts Agricultural College, showing that it would take \$60,000 for apparatus, books, plant-houses, domestic animals and farm fixtures, to put our farm and garden, and agricultural lecture-room in a condition to meet the demands of our pupils.

Such are a few of the many similar expressions respecting the practical and experimental character of the Agricultural College put on record during the contest over its location. Language could scarcely be more definite and emphatic.

The agricultural and horticultural associations of the State, and the State Board of Agriculture had but one mind on this subject. They were earnest advocates of the most liberal provision for the experimental and practical departments of the Agricultural College. The President and Curators of the University were quite as decided in their views, and as emphatically declared the necessity of ample provision for practical and experimental work.

The law too provides a "*perpetual fund, to be styled the Agricultural and Mechanical Fund,*" for the support of said College. The law also provides for the purchase "*of stock for improving a model or experimental farm of not less than 640 acres of land \* \* \* for the use of said College,*" and the donation of said farm by the county of Boone. And finally to secure the technico-practical features, and the entire integrity of the Industrial College, the law provides that "*one-third of the Curators shall be chosen from the State Board of Agriculture.*" We do not see how a law could more carefully provide for the professional and practical features of the College.

The Curators, to carry out the letter and spirit of the law at once, in 1870, appointed a Professor of Agriculture, and made it his special duty to teach the relations of science to agriculture, or show the connection between the science of the lecture-room and the work of the farm, by their application in the work of the farm.

It was definitely settled by the Curators themselves in adopting the course of study, that a graduate of the Agricultural College must have a good general education, be thoroughly trained in the sciences pertaining to agriculture, have a thorough technical knowledge of all farm operations and manual skill to use them all in the work of the farm. One item in the course of study will illustrate the meaning of this. Take the horse. The course of study requires a full scientific knowledge of the horse, his anatomy, physiology and diseases, together with his history, character and habits. This is the science. The course also requires the student to know the use of the horse, how he is managed, fed, clothed, housed, geared and worked. This is the technical education relating to the horse. But the course also requires the student to have the care of the horses, and manage their work and food, and report the results at the end of the week. This is the practical education.

The course of study adopted for the Agricultural College, also requires *one lecture per diem for four years*, either technical or practical, for the professional part of the course alone.

The President in his address at the next commencement after the location of the Agricultural College in the University, said :

"The University was trembling for its very existence. The problem was whether it was to be or not to be. The victory has been won. The future of the University is now established beyond a doubt. The University is now a part and parcel of the State itself. All this is the significance and meaning of the late act of the Legislature in creating the *Department of Agriculture and Mechanic Arts* in connection with the University.

"The Board of Curators will, in the amplest manner, so far as the endowment fund will permit, meet fairly and honestly the requirements of the act of Congress giving the land grant." In speaking of the requirements of the law, he says : "Note these words : '*practical education*'—'*industrial classes,*'" "That is its \* \* \* leading object." "The path of duty is made plain by the light of facts. We cannot—we cannot disappoint the hopes and expectations of these classes. To do so would be the

most wicked and perfidious of all acts. It would be to break faith—to deny all our pledges—to abjure our trust.”

What language could make the assurance stronger that the *practical* and *industrial features* should be made prominent! The report of the Committee on Reorganization, made December, 1870, and adopted by the Board of Curators, contains this language: “Yet the committee are fully aware how much there is to be done to make the Agricultural College of the State of Missouri worthy of the State.” Among the things needed are mentioned, “farm houses,” “dairy,” “agricultural machinery,” “barns and stables for domestic animals,” and “plant-houses.” (But none of these have yet been furnished the college.) But funds failed and the University appealed to the Legislature for aid to carry out in good faith the obligations of the State to the general Government, to build up and equip an Industrial College, and to the county of Boone to make the farm contributed and the Agricultural College of the greatest possible use to the *industrial classes*. “This,” said the President of the Board, in that magnificent plea for industrial education, “makes it necessary for the State to provide, not only buildings, but apparatus, libraries, stock of farms and other material aids for instruction.” “This General Assembly surely cannot consider it too much to be called upon to carry out in good faith the establishment of an Agricultural College by the erection of suitable buildings and by other necessary preparations to complete the Institution.” “Is not this,” said the President, “the very thing that Boone county bargained for in the gift of \$90,000 as a bonus \* \* \* for the location of the Agricultural College?” “Now does not good faith \* \* \* require the appropriation provided in this bill for the benefit of the Agricultural College?” And still again the President of the Board urges his claim for the benefit of the industrial classes, and the industrial classes only, in this strong language: “We have the literary and scientific advantages of the University, and hence ask *only* for the *industrial department*, the department set aside for us, the *farmers*, the *mechanics* and the *miners*.” Again he says, “We want the means of *experiment* and practice, and we must have them, if we are to keep pace with the spirit and progress of the times.” And yet the Agricultural College has not received a single “*means of experiment and practice*” which it did not have when this noble plea was made.

When the grant was obtained (1872.) of \$200,000, the Curators made appropriations of some \$10,000 for propagating houses, under-draining, books and apparatus for the agricultural rooms. And, besides, the President and Curators often declared our need of buildings, machinery, green-houses, propagating houses, dairy outfit, blooded stock and improved implements for all parts of the farm, and cabinets and apparatus for the agricultural lecture-rooms, and yet less than \$1,000 has been spent for all these purposes.

With all these facts before us, the decided character of public opinion for the last twenty-five years, the mandatory provisions of the law of Congress making the land grant, and the law of the State locating the College, the obligations growing out of the munificent gift of Boone county—\$90,000, providing a farm to establish this very feature of the College—the Faculty of the Agricultural College have felt bound by the most sacred obligations to give the students the best possible instruction in literature and science, and to show them, by all the means in our possession, the professional uses and practical applications of the sciences to the work of the farm. In this, we believe, we are carrying out the true design of the Agricultural College, and proving ourselves most faithful to the high trust committed to our care.

But we protest that there can be no honest and intelligent demand upon us to do more than the means at our disposal will permit; and we must be permitted to say that

our protest may be spiced with a little disappointment when such a demand (for brick without either straw or clay) comes from the very men who know we have no means to do the work demanded, and that they themselves, as Curators, have not been able to give us the facilities to do it.

## II.

*The relations of an Agricultural College to the University seem also to be misunderstood.* It was a matter of deep solicitude, and it was believed that the law locating the College had fixed its status and relations with sufficient care and distinctness.

The law of the State locating the Agricultural and Mechanical College, makes it "a distinct department," with special functions, creates a "separate and perpetual fund" for its support, a "separate Faculty," a distinct and professional course of study, *separate classes*, and *special designs*. The union is for special, economical purposes, and for mutual benefit, without the sacrifice of individuality. The Agricultural is as distinct a College as the Medical or the Law School. It has *always* (1870-1876) had its Faculty, its students, and its technical and practical instruction.

But the condition of our Agricultural College is by no means satisfactory. No one can regret the necessity for this humiliating confession more than the Faculty, who have exerted every power to make it subserve the ends for which it was established.

During the first years, (while the Curators furnished us with more liberal means, and while we were encouraged with the hope of library, apparatus, garden fixtures, farm machinery and fine stock,) the school filled up with 138 enthusiastic pupils of both sexes. We had a prosperous *Horticultural Society*, a *Vintage Festival*, and the praise of our energy and success came from all quarters. Even United States Senators gave our success as a reason for further aid, and the late President of the University, who seldom praised his co-workers, said, in a public circular: "The Agricultural and Horticultural courses are most efficiently managed."

But a change came. The Agricultural School, instead of being overshadowed, as apprehended and predicted, was overshadowing. While we were hastening to supply the means of instruction to prevent a decline, the decline was made inevitable by an action wholly unexpected. The appropriations for apparatus, library, propagating houses, under-draining, etc., above mentioned, were repealed, and our orders for apparatus were countermanded, and we were told to cut down all expenses to the lowest figure; and this order is still in force, and all the expenses of the last three years, carrying on the garden, vineyard, nursery, and all the experiments on corn, hedges, vines, forest trees and garden crops, have cost less than \$375 per annum. This covers the outlay for all our practical work and experiments.

This came upon us like a clap of thunder from a clear sky. Ruin was inevitable; and the Dean of the Faculty pleaded with the President, with the Curators, and with the Executive Committee, using the argument which the President had so well presented in his *plea* that "we must not lose the prestige of yearly progress," of success. "We must not lose what it will take years of labor to regain." Give some aid, make some promise, leave some hope to stand upon and to hold the noble band of students we had so interested. He saw the inevitable collapse, and with the energy of desperation he pleaded and begged as a mother for her noble sons.

"No Money," was the answer. But our agricultural students saw the apparatus and the books pouring into the other departments, while their special department was left destitute. By degrees the noble fellows dropped out. Some went to other States, some graduated in Science, some in Medicine and in Law, and are now teaching or practicing their professions. The number ran down from 138 to 15.

But we have labored on, with few words of cheer, hoping our rich and prosperous State would give us what is needed to make our college equal to those of our neighboring States, and that the departments of Technical and Practical Agriculture, the only departments we have peculiar to the Agricultural College, might yet share more liberally the aid given to this industrial school. And although we are laboring with so little to labor with, we are not half so mean as the representations of this committee would make us.

This committee of the Board of Agriculture could find no "*distinctive Agricultural School*," no "*systematic course of instruction in Agricultural Science*," no "*students pursuing*," and "*no professors conducting such a course*."

This is a dark picture; but fortunately it does not correctly represent a single feature of the school. We have a *distinct Agricultural College*, as we have sufficiently shown. We have a full systematic course of study "*embracing a regular schedule of agricultural science*," requiring *one lecture a day for four years* in the *technical and practical part alone*. Our course of study has received marked commendation from the highest authorities in the land. We have professors regularly and systematically teaching this course, and we have had students studying it all the time for six years, since September, 1870, when the first class was formed; and although this committee *could find no students*, two classes of agricultural students met two agricultural-professors every day for that whole year, and a third class did the same for a part of the year. We had fifteen agricultural students during that year, all engaged in the practical work of some department of husbandry, and we may add, our College has had more students of practical agriculture than any other school in the West, save, perhaps, that of Michigan College. They ascertained that no agricultural chemistry is taught. Still we have an excellent laboratory and a skillful professor ever ready to give instruction in that branch, and the course is open to all who choose to pursue it, and has been for several years.

This committee says "a portion of the vineyard had been ruined by bad pruning"—but this was a mistake. The failure did not come from bad pruning. Some of our vines died as did the vines of many other vineyards in that year, from the severe cold of the previous winter—the coldest ever known in this country—and from the severe drought of the following summer, when the soil was not wet from the 15th of June to the 15th of October.

They say our wine rotted because we failed "to rack-off at the proper time." But it was ruined before the time "to rack-off." If the committee had inquired the history of this wine from the professor who had the care of it, they would have been better satisfied, and would have learned a valuable lesson in the management of Agricultural Colleges, and our want of a few simple instruments for testing the strength of must and wine.

This report also says, "*all we have learned in the last fifty years, seems not to have reached the Agricultural College*." This is rather hard on the Curators and Faculty, and even on the Board of Agriculture, who have always, till lately, had several of its members in the Board of Curators, and one of them is now a Curator and on the farm committee. We have sought information, asked for books and periodicals to inform us, and we have purchased the books used in the European Agricultural Colleges, but we, like all others, are still ignorant of many of the laws which control the assimilation and growth of plants and animals. We cannot even foretell with certainty the conditions of the weather without Meteorological instruments, how much cold will kill peaches, grapes, pears, apricots and other fruits without a thermometer, nor just how fast the wind is, and how much rain falls, or how moist the air is, nor how hot, without



instruments. We hope the Board will aid us in our efforts to obtain the means of knowledge.

The committee found no indications of even "small experiments." And yet, nature and science and art were working out several experiments which had been in progress for several years, and they are still working slowly to reliable results. One of these experiments was instituted at the suggestion of one of this very committee several years since. The hedge in this experiment is not quite grown; yet many have pronounced it the best hedge they had seen. We are experimenting with six different kinds of hedges.

We have experimented with fifty different varieties of grapes, many apples, pears, plums, figs, several wild fruits, forest trees on different soils and various processes of making wine. All of which are still in progress, and will be reported as soon as reliable results are reached. But the most important experiments have been made on soil exhausted by fifty years of cultivation, mostly in corn. We have raised from this exhausted soil good crops every year for six years, without manure or dressing of any kind, and notwithstanding there was not rain enough in one year from June 15 to October 15, to wet the surface of the ground. This committee could have seen these and other experiments in progress had they inquired of the officers in charge. We have several times asked for means to carry on other experiments, such as under-draining and the comparative culture of different varieties of wheat. But there was no money. It may be proper to state that it is our opinion that colleges of limited means will better serve the ends of their creation by devoting the most of their energies to teaching what is known, rather than in attempting to discover new principles, leaving the experiments for discovery which cost so much, to experimental stations and colleges with abundant means.

One member of the Board, in his remarks before that body, blamed the Professor of Agriculture for not making chemical experiments. He says: "One of the Professors in the Agricultural School in Michigan made an experiment which did not cost a dollar. He took a sod composed of herds' grass and clover, and found out, precisely, the amount of fertilizing power there was in that sod."

As this comes from a critic, who sets himself up to teach us our duties, because we are ignorant of what has been learned the last fifty years, we may be allowed to examine the lesson taught.

He said "It did not cost a dollar" to determine, precisely, the amount of fertilizing power in that sod." But it would take the chemist at least two weeks to do it, besides the cost of apparatus and re-agents. The precise analyses of the timothy and clover and soil in that sod would not cost less than *many dollars*. Again, the Professor of Agriculture has no apparatus for doing such work, and, besides, it is not his business to do it. It is the duty of the Professor of Applied Chemistry to make such analyses, when needed. This critic also says: "If Professor Swallow will do something like that, he will put a point before his scholars." But Professor Swallow puts precisely the same "point" before his scholars every year, in his lectures on *fertilizers*, and also in those on the *rotation of crops*, and that, too, without any expensive analyses; for it has long been a well-settled principle of agriculture, that sods are rich fertilizers, and that clover is a good crop for restoring fertility in a rotation of crops, and for rendering barren soils fertile. Professor Swallow used clover for these purposes forty years ago. Many will remember the extensive "pine-barrens" west of Albany, New York, and how clover and gypsum made them one of the most productive regions of the Empire State; and, besides, Professor Swallow had a pupil, Mr. Ferlur, in the Agricultural Laboratory in Hampden, Maine, in 1849, who determined, by careful

analysis, just what elements, and how much of each, an acre of clover would restore to the soil, and the results were published at the time in the *Portland Argus*, and were used by him in his prize essay, written, in 1856, for the "Missouri Agricultural and Mechanical Association," and published, with its premium lists, at Boonville, 1857, and copied in the Report of this Board of Agriculture for 1866. So, these facts were well known and applied by Professor Swallow before the Michigan Agricultural College was founded; and all intelligent teachers of agriculture have put that "point" before their pupils for the last twenty-five years, at least. [This very "point" was actively discussed by Mr. Geddes and others, before the Agricultural Society of the State of New York, as far back as the year 1845.]

This report also says that "the Professor of Agriculture gives so large a portion of his time to teaching other University students, \* \* \* that he has little time left to work up the subject of agriculture in a professional way."

It is true that the Professor of Agriculture has been greatly overtaken, and yet the Professor of Agriculture has not, for a single day, neglected a single pupil who wished instruction in agriculture. His course of instruction comprises five hundred lectures. Many of these lectures are given in the field in connection with working lessons.

The Report also says: "The President of the University and the President and members of the Board of Curators agree that a distinct department of agriculture, including some simple and useful experiments *ought* to be maintained, and so far as the income belonging to this department is concerned, *can* be maintained." The Faculty of the Agricultural College is rejoiced to learn this fact, and they are ready to institute and carry out any experiments that promise valuable results, and for the completion of which the funds may be provided. Nothing can be more pleasant than experimental studies. We have had several experiments in mind which we have for years desired to put in operation, but have not had the means. Others we have carried on with the means in hand, *viz.*: A worn-out garden plat, and \$375 a year.

The Faculty of the Agricultural College are the more confirmed in their convictions that the course of study must be made technical and practical by the past history and general tendency of public opinion in that direction.

The Commissioner of Agriculture says in his last Report: "The disposition of the Curators of these colleges during the year, appears to have been to make them *more industrial and less literary* in their character, and to make labor compulsory so far as it is educational," "but beyond this leave it voluntary and to pay for it." This has been precisely the idea of our Faculty from the beginning, as shown by our course of study, and the explanations of it in all our catalogues and reports.

The National Grange, now in session at Chicago, call attention to the great need of a more practical education, and that the youths must be educated to esteem labor as honorable. These opinions, too, are in exact accordance with our published views of the design and duty of our Agricultural College, as published in all our catalogues and reports; as on page 75 of our report of 1876, we say: "Our graduates must be the peers of scholars in mental culture, and the equals of laborers in manual skill and physical development, that they may be prepared to honor labor and utilize and dignify learning. \* \* \*

Our Industrial College, then, must be a school of labor as well as of study." Every student, from the beginning, has been a student of work—a cheerful one too. Some have at first protested that they had learned to work; but when they saw that they could not do it as well as the Professor of Agriculture, they became cheerful students of the work.

So much we have said in defense of the school we have in charge, as a part of our duty to it and to the State; but this report of the Board of Agriculture for 1876, has the tone and spirit of a personal assault on more than one of the professors. So far, we have made no personal defense; but we wish in conclusion to say, that even professors have some rights. When a professor assumes the duty of a chair in a school, there is an implied obligation to furnish him the necessary means of doing his work. When the professor of agriculture undertook his work, there was no means of doing it. He had a naked farm and an empty lecture-room. But the State Board of Agriculture, as we have shown, had published its ideal of the College, which gave the professor of agriculture *eight assistants*, skilled in the various departments of husbandry, and a lecture-room filled with the apparatus needed for technical instruction. The President had drawn his ideal of a farm, stretching from the University to the Hinkston, and covered with all farm buildings, orchards, vineyards, gardens and conservatories for practical work, and a scientific building filled with apparatus for technical instruction; and the Curators referred us to the Agricultural Institute of Hohenheim, with all its princely proportions and prodigal appliances, as a model to which they would work. Such were the prospects held out to the professor of agriculture when he undertook the work. For three years the school progressed in numbers beyond all our expectations. But when our small appropriations were repealed, and we were told we could not have even \$1,000 a year for all practical purposes of the College, and when we took an inventory of our means to make the College what you expected, and found instead of your *eight skilled assistants*, one negro laborer, a few poor garden tools, and a hot-bed, instead of Hohenheim, with all its profuse appliances, a few books, all of which one can carry in his arms, a few colored engravings of fruit, and some old bones, picked up in the pastures, we saw but small prospect for an Agricultural College. And yet with our negro man and hot-bed, and vineyard and \$375 per annum for all expenses, you expect us to compete with the best schools in the country, whose lecture-rooms are filled with the best apparatus, and whose farms are stocked with blooded animals, and whose conservatories are filled with all fruits, and which, like the schools of Massachusetts and Pennsylvania, have \$8,000 a year for farm expenses.

In this you expect too much. Up to this time, be it known, our Faculty has made no complaint of those who have undertaken to manage this school. They are our superiors. But now, will you permit us to say, we were entitled to your sympathy rather than to your complaints. Has any one of you, for the last three years, come to cheer and consult, and advise as to what we could best do with our small means? Our biennial applications for aid have received no substantial response, nor advice or hope, save once. The response then was, "We have no money, and you must cut down your expenses to the lowest possible figure." That direction we have obeyed to the letter.

Very respectfully submitted,

G. C. SWALLOW,

*Chairman of the Committee and Dean of Ag. College Faculty.*

# STOCK-FEEDING.

BY ISAAC A. HEDGES, ST. LOUIS.

DEAR SIR: In compliance with your request, I have the pleasure of submitting the following plan and accompanying discussion upon the subject of stock-feeding, for publication, which I propose to arrange under the following heads:

1. General remarks relative to the subject.
2. Preparation for the business; selection of location, etc.
3. Buildings—such as the stalls, corn-cribs, forage-lofts, etc.
4. Water supply—its importance, etc.
5. Feed—its constituents and preparation.
6. Machinery—kinds, cost, etc.
7. Corn cobs as food.
8. Operating process and detail.
9. Recapitulation.

## GENERAL REMARKS.

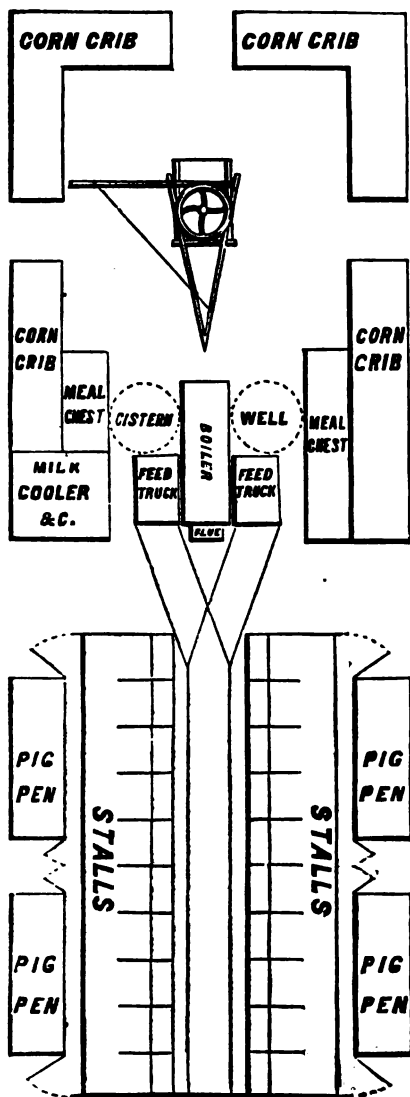
In no department of agricultural pursuit has there been less improvement than in that of stock-feeding. With but few exceptions, the usual rough-and-tumble method of out-door feeding with corn cut at the ground and tumbled out—sometimes in the mud, sometimes in the snow—where the lesser animals have to shirk and dodge the greater, with the hogs chasing after to give variety to the performance, and reclaim some of the grain that has been wasted in the processes of mud-tramping, as well as imperfect mastication and digestion. I have found the common reply of those large feeders, who are feeding one hundred head or more, to be, that they could not afford to erect stalls and feed ground feed upon so large a scale. This is certainly very illogical, and directly opposed to the experiences of all other kinds of business, and especially that of manufacturing, where it is well proven that the more extensive the business, the better are those engaged in it enabled to prepare for it. What would be the cost of your plows, reapers, sewing machines, etc., if they were made in small shops in every little town? The same qualification is required to superintend the small as the large business, while the latter can afford to invest large sums in mechanical appliances that largely facilitate the work and make uniformity certain, and, at the same time, lessen the cost largely.

Now, if farmers expect to compete successfully in their operations, the same as the manufacturer and mechanic, they must, like them, systematize and concentrate their efforts, and avail themselves of all the advantages possible, in such a manner that one man can do the work of six, and one bushel of corn will equal two or more as ordinarily fed, besides a saving of one-third of time in fattening the animal.

There is another essential gain in the improved method of feeding, in the quality of the beef or pork, by which a higher price is obtained. It is well known that the meat of animals of slow growth is fibrous, tough and tasteless, possessing a limited

amount of nutrition; while that of rapid growth is tender, juicy, of fine flavor, and full of nutrition, commanding the highest prices in the market. This business of making beef, pork, butter, cheese, etc., is a manufacturing business, and those engaging in it should bring to their aid every possible advantage, in order to make it a success equal to their cotemporaries in other lines of business. They need not have the fear of establishing permanent works that mechanics have, for no inventor is likely to supersede them by getting a patent for a substitute for beef and pork, or any new way of making it. I shall endeavor to set forth, in the subjoined plan and specifications, the chief features requisite for an establishment, which may serve as a guide, if it is not adopted precisely as given. The ground-plan is one-sixteenth of an inch to the foot; the elevation one-eighth of an inch to the foot.

#### PREPARATION FOR THE BUSINESS.



The first step taken should be to determine the extent of your ability to start; that is, how many head to provide for in a substantial manner, without danger of falling. The plan or purpose should be settled during the winter, in order to grow such crops in the coming summer as shall be suited to prosecute the business. Besides, the leisure hours and days of winter, spring and summer can be profitably employed in building the factory. But, before commencing, seek all possible information, by discussions, correspondence and reading, to the end that a correct start may be made, as it is much better to avoid mistakes than to correct them afterwards. This should be one of the leading subjects of debate in club and grange meetings.

If there is a lack of means to start by a single party, it would be well to associate by some safe and simple method enough persons to aggregate the required capital to make a sure basis for the prosecution of the business successfully. There must be due allowance made in this as in all other enterprises of like character, for the incidental drawbacks consequent upon the oversights of new beginners. One thing, however, is certain, that good, cheap stock, and cheap feed, well prepared and fed to well-sheltered stock, will pay and ever has paid. I have been intimately associated with the stock-feeders of the Northwest for more than a quarter of a century, furnishing them with machinery; meeting them upon their planta-

tions, at fairs and in conventions where stock-growing and feeding has been the great theme of discussion, and I can testify, most clearly, that in no instance has there been even a doubt expressed adverse to the position above stated. If our country banks and other corporations, having surplus funds, would invest them, or loan them, to be invested in stock for such factories as are here contemplated, upon as good terms as they do to pork-packers, grain merchants, etc., who buy up and then monopolize the market of those products, it would undoubtedly better serve the general welfare of the people at large, and be quite as safe and profitable to themselves. To the feeder who has a large stock and is without means to adopt a better plan of feeding, I would say: sell off a portion, and with the proceeds erect the factory for the balance, by which, in the saving of corn and the increased value of those fed, there will be realized enough to clear the investment made in the works, as I shall endeavor to prove under another head of this treatise.

### BUILDINGS—THEIR ARRANGEMENTS, Etc.

The ground for such an establishment should be high, dry and healthy, with a gentle descent to the south or east, if possible, to avoid the cold winds. By reference to the annexed engraving, it will be seen that the ground plan represents a double tier of stalls, with a rail-track passage in the centre. This line may be extended to any desired number of stalls; hence a slight descent to favor trucking the feed or flowing water through their mangers in inclement weather, as an hour of exposure in such weather, drinking ice-cold water, is very damaging to stock from a warm stable.

It may not be amiss to describe here a simple and cheap process of making a thatched roof, for which rye straw is preferable. One acre, even, if sown in the spring and cut with a cradle or dropper reaper close to the ground when in blossom, well cured, and bound in bundles about six inches diameter in the band, will cover all the buildings needed for a large establishment.

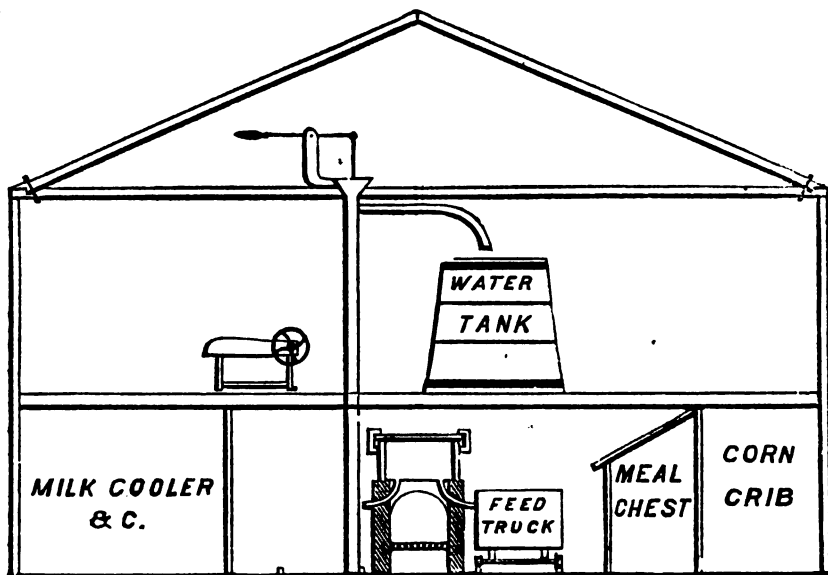
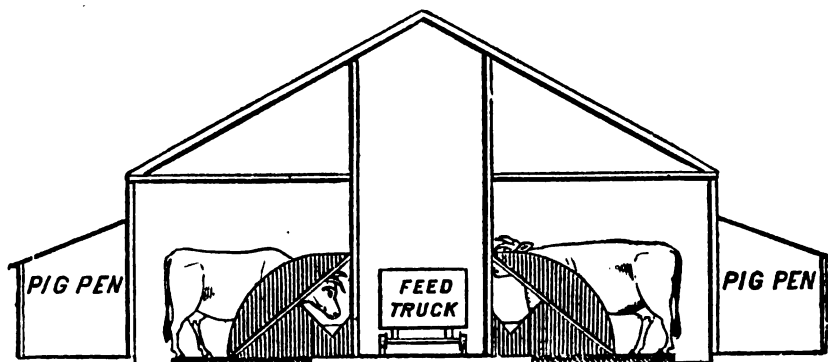
### CONSTRUCTION OF THE ROOF.

Sectional rafters about four feet apart (roof of about one-third pitch); across these rafters nail slats or small poles; if of the former, 1x2 inches, same distance as the length of your bundles from butt to band. It will be well to use either two courses of shingles or a good wide board at the eaves, to facilitate attaching an eave trough, if such is desired. Let the first course of the butts of straw range three or four inches above the butts of the shingles; fasten the bundles by passing a little handful of the straw from the underside of the bundle around the slat, with the band of the bundle resting just above the slat, crowding the bundles close, which will hold the straw wrapped around the slat. The next and succeeding courses should lap just below the band; will have to part the top end to pass the band around the slats. Such roofs are cheaper and warmer than shingles, and will last ten or more years.

The feed preparing department should be a thorough structure, with corn cribs, hay or fodder lofts, meal chests, mill space, and a spacious root cellar under the whole building. The position of these are indicated by the ground plan. This building should be about 40x50 feet, and two stories; the upper story to serve as a repository for such fodder as is desired for chopping and mixing with the slop below. The corn could be elevated into it by power, and there ground, letting the meal descend through spouts into the chests below, thus saving hand labor. In this loft should be a water tank, as seen in the cut. Into this the water can be raised by power-pumps from well

or cistern below. The importance of this elevated water tank will be appreciated when the working process is described.

I must impress upon the mind of the feeder the great importance of shelter for stock. It is safe to say that twenty-five per cent. is gained thereby, as during at least one-third of the season—from November to April—stock that are exposed without shelter, will not gain at all, although fed to their full satisfaction; hence they are merely



boarders on charity. I read the statement of a feeder of Champaign county, Illinois, some four years since, who fed eighty head in stall and sixty head out-door—each having feed alike as to quality—while the sixty outside required more than the eighty in stall; and at the end of the season he found the stall-fed had increased much more per head than the others, making beef at the same time that sold higher than those fed outside. It is hardly necessary to say why this is the case, for it is well known that the cold has to be counteracted by the food. Hence it is better to shelter and keep stock in a thriving condition through the winter, than to grow corn, hay, etc., in the summer, merely to keep them warm in the cold, stormy days of winter. I add here

estimates of the plan annexed, as made some three years since, when materials were higher than at this time.

### WATER SUPPLY AND ITS IMPORTANCE.

Pure spring, well or cistern water, and an abundance of it, is very essential to the success of this business. It has been well known that slop—even thin slop—favored the production of milk, and also contributed to fattening hogs and cattle; but the particular philosophy of it had never met my observation so forcibly as in perusing the October number of the Medical Brief, edited by J. J. Lawrence, M. D., of this city, under the heading of "Drinking of much fluid the cause of obesity." I find the following:

"Since making the treatment of obesity somewhat of a specialty, I am fully convinced that the drinking of much water, or other fluid, is one of the principal causes of obesity, the oxygen and hydrogen of water forming with the carbon of food to make fat.

"Mr. M. Dancel adverts to a circumstance hitherto completely overlooked by professional men who have made the cure of obesity their peculiar study. While collecting observations concerning the cure of obesity in men, he remarked that those who fed on substances containing little or no adipose matter did not diminish in corpulency when they drank much, and it struck him that water and watery substances must favor obesity. The experiments he made proved this to be a fact, and he now expresses surprise at finding that among the many experiments tried for the fattening of animals, the water, often absorbed in considerable quantities by the subject was never taken into account, while he now shows that water plays a great part in producing obesity, as may be perceived from the following experiment: Among the horses of the regiment of the Garde de Paris there was one remarkable for its leanness. At Dr. Dancel's request, the veterinary surgeon of the regiment diminished its daily ration of oats to three pounds per day, while it was supplied with abundance of water, into which a pound of bran was put. In the course of twenty-seven days, it increased about thirty-six pounds in weight. In the same regiment, an exceedingly fat mare, that could hardly carry its rider, was reduced from an allowance of sixty litres of water per day to fifteen, and speedily lost its obesity, resuming its former vigor. I think the corpulency of beer-drinkers is due more to the amount of fluid drank than any fattening properties of the beer, fat persons being generally great consumers of fluids. In all the cases of successful treatment of excessive corpulency, the amount of fluid taken has been diminished to the least possible amount."

M. M. GRIFFITH, M. D.

PARSONS, LUZERNE CO., PA., Sept. 1876.

Mr. Wm. S. Nivin, a farmer near Bunker Hill, Illinois, stated in my hearing, upon our fairgrounds, in this city, last fall, that his method of feeding his cows all last winter was to crush his ear-corn on a No. 2 improved Little Giant; shovel the meal into a vat or tub, covering it with boiling water; let it stand closely covered some twelve hours; then he put an ordinary wash-basin full of this with one of wheat bran, with plenty of water, as one feeding, into the manger of each cow. This, he found, was ample; while the flow of milk was very satisfactory, both in quantity and quality, and his cows were good beef in the spring.

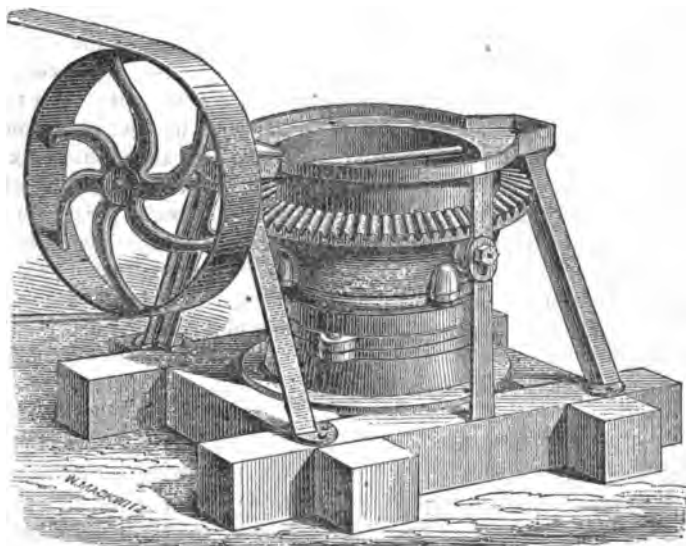
The still slop now being used by the city dairymen is certainly very little more than water. It is true they add some other provender to it, but still it is a remarkably thin soup. There is in it, however, one constituent that deserves notice, and to it I wish to call special attention, as I have done before some years since: that is the acid it contains. It is well understood that the mash has to undergo fermentation beyond



the vinous or small beer to that of the alcoholic, before the spirit can be obtained by evaporation; this slop is consequently left quite acid, and of the acetic kind I have found by the test of litmus paper that the effect was fully equal to that of a sour apple. Now, it is almost certain that this acid is one of the principal and most important constituents of this slop. All green vegetation possesses a degree of free acid, a portion of which is transformed into sugar, starch, etc., as the plant matures. Young grass I found very acid; even sugar cane is the same until it has had full growth and been exposed to the alternate actions of hot sun and cool shade, whereby the carbon and oxygen unite with the hydrogen already abundant in the plant, and thus develop the saccharine. This acid in the grasses is not only nourishing, but stimulating to the appetite, and at the same time facilitates digestion to that degree that the animal will eat large quantities and appropriate the nourishment, grow and become fat. It will be remembered that this young grass is full of water also, which sustains M. Dancel's theory.

#### FOOD—ITS CONSTITUENTS AND PREPARATION.

Corn must be considered the principal ingredient in this country for feeding all kinds of stock; hence the most economical method of handling and preparing it will be the first point to discuss. It will be perceived by the previous positions assumed that a slope of some kind is essential; hence the corn must be ground by some means, so that it may be freely permeated with water which has been prepared, and contains such properties as shall, when combined with the meal, etc., constitute a food approach-



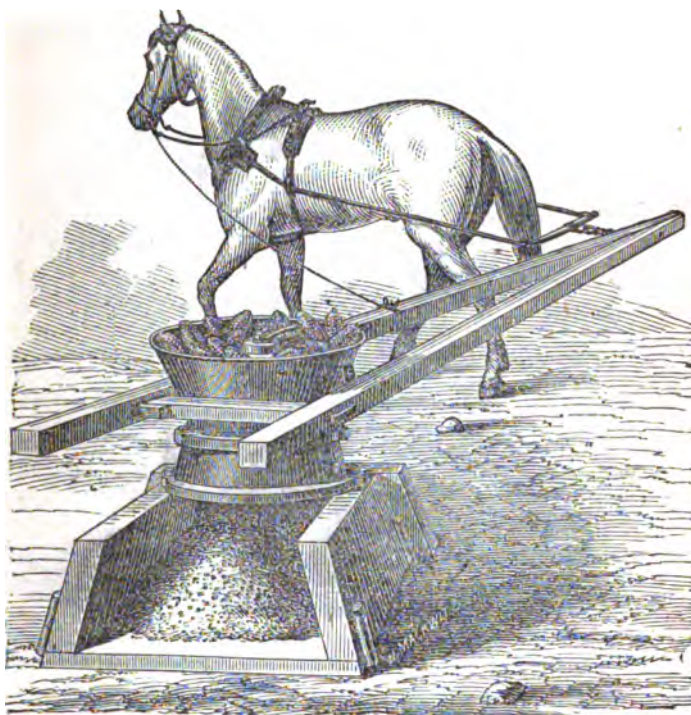
ing as near as possible to nature's best feed—green grass. Stock will fatten and grow if fed upon dry corn, under favorable circumstances; but the great object should be to obtain the largest amount and best quality of beef, pork, etc., with the least amount of grain and expense. Five months' feeding is about the minimum, and seven months the maximum time of grain feeding for neat stock; hogs much less, say from three to four.

Mr. Stephen T. Lupe, of La Monte, Pettis county, Missouri, wrote me, under date of December 27, 1875, that in feeding forty-eight head of steers with corn crushed upon

an improved Little Giant, they ate at the rate of sixteen bushels of seventy pounds per day, fed dry. The average increased weight in thirty days was sixty-seven pounds per head. By this it will be seen that he realized about seven pounds of beef for each bushel of corn.

Now, according to Mr. Nivin's statement, his milch cows (that will eat as much or more than fattening steers) could not have consumed over one-half as much as Mr. Lupe's steers, which may indicate the importance of water in the food.

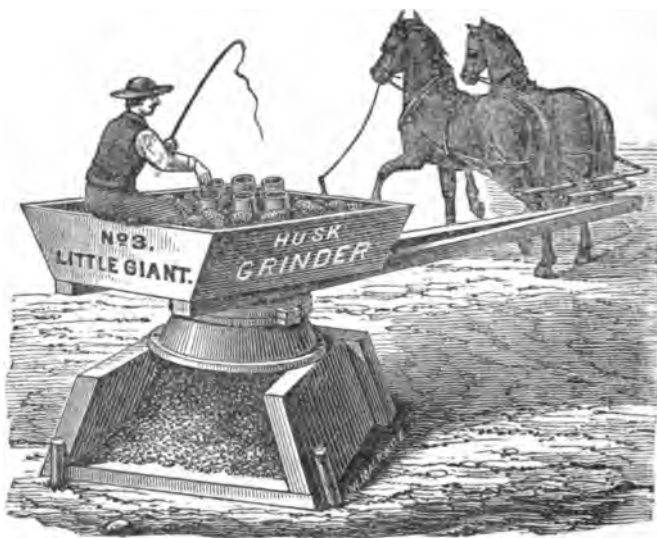
I heard the statements of several large feeders in central Iowa, at a club meeting in Marshall county, who agreed that steers four or five years old, require a half bushel



of corn per day as an average feed, where fed in the rough out-door way. They say also that an increase of three hundred pounds on a twelve-hundred-pound steer, in six months' feeding, say from October 1st to April 1st, is as much as can be expected. By this it will be seen that a steer consumes fifteen bushels in thirty days, and increases fifty pounds in weight, giving three and one-third pounds per bushel of corn. It will be readily seen that this will not pay where corn is worth over fifteen cents per bushel. By the statement of Mr. S. T. Lupe, we find that, by simply grinding and feeding in stall, he obtained seven pounds per bushel. I am fully convinced that ten, and probably twelve pounds may be made from each bushel of corn, or its equivalent of something else added with it.

Now, I am confident that there is needed in this feed an acid equivalent at least to the amount in the fresh-growing grasses. Fermentation would do probably, were it practicable (which it is not), but the use of a cheap mineral acid is practicable, and at all times available. Muriatic acid is considered by medical men as nearly identical with the acid of the stomach, and is often prescribed in diluted form to persons of

feeble digestions and lack of appetite. This will cost at this time five cents per pound by the carboy. I have found, by experiment, that one pound will render sixty gallons of water as acid as the peachblow potato; hence, about one pint in forty gallons of water would not be an excess. It should be added to the water before it is poured upon the feed, in order to make a thorough impregnation of the mess. In the use of salt, also (which is important), it should be in every mess, by infusing the water before mixing the feed. I can see no reason why the food of cattle, hogs, etc., should not have salt equal to the amount in the food of mankind, who seldom eat a meal without both salt and acid, too. Stock of all kinds are quite as fond of it as we are, and if its use is judicious at all, then it should be in each mess in due proportion—probably two-ounces in each mess of fifteen or eighteen quarts of slop. This slop may be cooked, or



simply scalded, as is being done by many feeders at this time. I am not clear whether the latter is not as good, especially for cattle. Boiling water, turned freely upon the feed in tubs or boxes with closed lids, will steep and soften the mess so well in ten or twelve hours' time as to make the feed soft and easy of mastication and digestion. Stock should have changes in their feed as much as mankind, in order to keep up a steady appetite and healthy condition. This is better understood by eastern and European feeders, who not only raise a great variety of coarse grain and grasses, but also of vegetables, and then buy of us annually large quantities of oil-cake to feed their stock. They, however, have not our corn, nor can they afford to import it for stock-feeding; hence they resort to the oil-cake and other strongly nutritious articles of food to equal our corn as a base. There are several kinds of artificially prepared food now largely advertised as possessing some extraordinary qualities for stock feed. As to their importance I am not informed, but I would suggest whether it would not be better to first put in practice in this most productive valley of the world, all of those well established methods employed elsewhere so successfully, and improve upon those also, if possible, with the means already in our own hands, and of our own production.

I have heard farmers remark that they could not afford to grind corn when it is so

cheap as it is sometimes here in the west. Now, suppose it to be worth only fifteen cents per bushel at the depot or landing, and it must be sold. By grinding and feeding, as Mr. Lupe has, each bushel will make seven pounds of beef, worth say four cents per pound, returning twenty-eight cents per bushel; or, if fed in thin slop, as Mr. Nivin does, each bushel may return forty cents or more. It will be seen that I have put the price of beef at four cents, while if fattened as it should be, it would probably sell higher; besides the increased weight is not the only profit; the whole weight is advanced in value; for instance, the steer weighing twelve hundred pounds, costing not over three dollars for one hundred pounds, each pound is increased two cents, which will make the final showing thus:

Cost of steer of twelve hundred pounds at three cents per pound, thirty-six dollars; thirty bushels of corn at fifteen cents per bushel, four dollars and a half; hay and other ingredients, four dollars and a half; labor, etc., say five dollars; total, fifty dollars. If fed six months, and increase only at the rate given by Mr. Lupe, say sixty-seven pounds per month, it will give four hundred and two pounds, making sixteen hundred pounds, which, at five cents per pound, would be eighty dollars, leaving a net balance of thirty dollars per head.

There is another important benefit to the farm, besides the thirty dollars between-selling corn from his farm and that of feeding on the farm, i. e., the improvement to his land by the fertilization, which will fully equal the interest of capital and wear and tear of machinery. This arrangement of feeding will afford winter work for hands, and thus enable the farmer to keep good men, by giving them permanent employment, by which they will become expert in their avocation, and freed from the present tendency to idleness, dissipation and crime, consequent upon the simple grain-growing or summer work.

#### MILLS, MACHINERY, Etc.

In the selection of machinery, the extent of the business will govern the choice. I cannot recommend the use of steam-power, except to those who are themselves to some extent skilled in the use and management of engines, or are willing to pay the wages requisite to secure a skilled engineer, as one mistake may cost more than a whole year's business. With such security, however, steam-power is most desirable, and cheaper than horse-power. With a six or eight-horse-power engine and ten bushels of coal, the whole work of grinding corn, cutting stalks, hay, straw or vegetables; pumping and heating water, elevating corn, etc., for an establishment for two hundred head, all can be done with ease and dispatch. There are threshing engines in many sections that are idle generally through the feeding season that could be employed and serve well with very little additional machinery. In such case, the advice of a competent mechanic should be obtained to place and arrange the machinery to suit the business. The best position for the engine would be where the boiler is represented in the diagram.

The use of a large sized lever-mill, position as represented in the cut, say No. 4 improved Little Giant, that will employ three or four horses and crush some twenty-five bushels of the feed per hour, will be ample to do the work for feeding two hundred head in three hours each day. Hence, about two days' work in a week will keep the works running. For such coarse grinding, simple iron mills, arranged for renewing grinders when worn out, will be found more economical than burr-stones, which latter calls for more skilled labor for operating than the former.

For the purpose of placing before the mind of those considering this subject all the facilities possible, I annex hereto also cuts of three different mills of the same series, viz.: Geared No. 1, improved Little Giant, and Lever-mill, as shown in ground

plan—except with only single lever. Also, No. 3 improved Little Giant for grinding with the husk on the ear. This mill No. 3 will assist to incorporate additional roughness in the feed that may prove it to be the most desirable of all others.

In the foregoing discussion, I have given more attention to a larger class of operations than that of the great mass of feeders. It will not do to overlook those, nor allow that they cannot avail themselves of some improvement in their way of feeding. It is an old saying that "half a loaf is better than no bread," and so is the half of a stable better than none at all. Posts well set in the ground, forming a line east and west, and boarded up on the north side to about six feet high, nailing the boards horizontally—hinging one line of boards at suitable height for openings through which to pass feed into mangers, arranged securely to the posts on the south side. By setting a second line of posts about twelve feet south of the first, with an intermediate one, each of suitable increased length, to give the right pitch for a roof, it will require but little labor or skill to complete a wind-break that will protect stock very largely from the storm, and provide mangers for feeding ground feed, or even slop, except in the most inclement weather. The lesser sized mill, say No. 1 or 2, would serve for such an arrangement, and could be set on the north side—and should be under cover, if possible, in order to be used in bad weather, if needed—in fact, bad weather is just the time to use such, as it is improving the time when little else can be well done.

One great reason that such mills have been laid by in former days was, because of the lack of a comfortable and safe place to work them. If exposed and corn left in them, rain and snow fall in, freezing there, either bursts the mill, or sets it so fast that it cannot be started without breaking something—besides, if it is left out without cover through the spring and summer, the rusting will greatly damage the grinders.

Boilers for heating water can be made of sheet iron with plank sides—using about No. 20 iron, two feet wide and eight or ten feet long; the plank should be about twelve inches wide and two thick, and of good firm wood that will hold nails—using about one-inch clout nail. This tank set upon a well arranged arch, with a fire-door and grating at one end and chimney at the other. The walls of the arch should be about six inches less in width than the iron bottom—such boiler and furnace complete will not cost more than \$40. It will not do to boil the feed in pans or kettles of any kind, as it will soon adhere and burn on a coating, and render them useless.

### CORN COBS AS FOOD.

Many persons object to the use of cobs as food. But those who eat them I consider the best judges, and I have ever found that stock, both horses and cattle, would eat the whole ear as long as they could masticate it, and this fact was the inducement for making cheap masticators, or mills, of iron that they could use with their traces. There are properties in the cobs such as potash, that are appropriated to the formation of bone, without which an animal would fail to have the requisite frame and strength to attain a full development; or, in other words, they would become nice fat *little* creatures.

In regard to a mill for grinding, I presume there cannot be found any form of mill that will do as much work and as well, costing at the same time as little money, all things considered, as the improved Little Giant, a cast iron mill, very simple, and of sizes to suit every class of operation.

The horse-power or lever-mill is for all uses, when there is no engine or water power. In my recapitulation or estimate, I shall embrace the No. 4 lever-mill, as it has capacity to do in a short time all the grinding required for a factory stalling from 50 to 200 head, which would require about 50 bushels per day of 70 pounds ear-corn. It

would employ this mill only some three hours to grind for the above number of cattle. The hand that attends it can keep up the fire under the boiler, fill and discharge it upon the feed, and stir in the meal. In order to facilitate the work, the water should be pumped from the well or cistern, directly into a tank in the loft over the boiler, from which it can be drawn through a pipe and faucet very quickly when needed. (See elevation cut.) In order to expedite all such work, everything should be so adjusted that each manipulation can be performed in the least possible time.

The tank is represented as six feet high and six feet in diameter, and will hold, therefore, about 1,000 gallons. I recommend a large tank in this place for several reasons: besides the use of water for making feed, it may be needed for watering stock in the stalls by letting it run down in their mangers, which are, or should be, constructed to answer that purpose, by making a V shaped manger, with a slight obstruction, which may be a brick-bat across at each stall, that can be removed at pleasure, and allow the manger to run out dry. This provision for watering will save the stock from exposure in stormy or extreme cold weather, which would damage them greatly, if turned out. A good supply of water in this loft would save the trouble of starting up the pump every day; and, again, should fire, by any oversight, get started about the furnace below, by having a hose attached, it would serve well in extinguishing it. Water can be drawn from this also to wash down the channel behind the cattle, especially where milch cows are kept, which should be done daily, except in freezing weather. It is not possible to keep such stables too clean, as the foul odors are imparted to the milk, and, more or less, to the meat also. May not sickness result among stock from inhaling foul air, as well as mankind? How sweet the meat of the mountain grasses and animals! The deer, elk, antelope, etc., etc.—they have pure air, food and water.

It will be recollected that I recommended, in the choice of ground for a range of stalls, that a gentle slope was necessary; the reason for this is now apparent. The cut shows on each side a range of pig-pens, which may or may not be required. Should the cattle fail to fully digest and appropriate all the nutrition in their food, the droppings can be thrown into the pens, and from thence hauled away.

The manure from such factories, if extensive, will enrich the adjacent farms to a considerable distance around. It would be better to establish these factories upon the coöperative plan than to start upon too small a scale, especially in beef-making, and where three or four farmers are joining lands, with roads suited to convey their products to the factory. It may be found a good plan for them to coöperate in carrying on such an establishment. The joint stock incorporation plan is very good; but in whatever form the business is done, there should be the most careful attention given to the accounts day by day; which accounts should embrace everything appertaining to the concern. If it is a beef-fattening one, each animal should be numbered and entered upon the books—weight, age, sex and breed, as well as cost. A daily journal should be kept, noting the range of the thermometer, the weather, etc.; the kind of food and quantity, as well as every incidental change that may occur upon the change of food, etc.; the weight of the entire stock taken, at least every thirty days, and a trial balance of books made, as well as the individual account of each animal stated in the ledger, in order to know, as the business progresses, whether success is being obtained, and at what rate. The use of a good hay and cattle scale is indispensable to this business, whether it is a beef, pork or milk factory. The plan of going it blind, or by guess, a whole season, is old foggy and unsafe; besides, it is as important to know, at the end of the season, upon what you have made or lost money, as it is to know it at all. This knowledge is requisite as a guide for future operations.

What will be the cost of such building and fixtures, is the first question that arises in the mind of the feeder or farmer upon examining the above plan. That will depend upon the kind of buildings erected, whether of brick or wood, and the price of such materials. I introduce here the estimate of Mr. J. M. Lane, a builder of this city. In answer to my inquiry, he says: "The stable, with shingle roof will cost about \$250, but could be somewhat cheaper with plank or clapboard roof. The main building could be built at a cost of \$500, in a good substantial manner, where lumber can be had at \$20 per thousand feet. In a country place, where small, round oak timber can be had, these buildings can be constructed by setting posts in the ground which will last a number of years, and cost very much less."

No. 4 Improved Little Giant, \$85 ; extra grinders, \$20 ; total.....	\$ 105
An 8 feet by 26-inch wide boiler, with two draw-off pipes in the bottom, lid and clamps complete, about.....	75
Fire-fronts, grates and flue-plate.....	20
Two feed trucks, with wheels, axels and lid for clamping down, each \$20	40
Water tank, holding 1000 gallons, about.....	35
Cistern holding 200 barrels of 40 gallons each.....	125
Well, say 25 feet deep.....	25
Force-pump and 35 feet of 2-inch pipe, with gear.....	80
Fodder cutter for power, large size.....	75
Machinery for working cutter and pump by the horses on the mill, will cost about.....	125
Belting, etc.....	15
<b>Total.....</b>	<b>\$ 720</b>

These figures are upon fixtures of sufficient capacity for one hundred head or more. If a steam-boiler is substituted for the pan, as described, the cost will be something more, according to size and kind. In selecting and using such, attention to safety, economy of fuel and convenience of use must be considered. A simple upright boiler, with center flue, iron 3-16 inches thick, with grates, fire-doors, already for use and quite portable, with 25 feet fire-surface, will cost some \$150 ; a less one, of 15 feet fire surface, will cost \$100.

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# COUNTY REPORTS.

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# COUNTY REPORTS.

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[NOTE—The list of County Reports is not complete. This is not from want of diligent correspondence to secure correspondence, but from a failure to find persons in some counties who were willing to assume the task, and, in some instances, from the fact that those who had consented to report waited for the census, only to be disappointed. From these causes the county statistics will only be partial.—J. M., *Secretary.*]

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## BARRY COUNTY.

Face of country—Forest, per cent., 85; bottom land, per cent., 10; prairie, per cent., 5.

Timber—Number of acres, 250,000; varieties, white, black and post oak, pine, elm, walnut and hickory.

Principal streams and water-power—White river, Roaring river, Flat creek; water-power, very good.

Minerals developed—Lead.

Building material—Lime, sand and cotton-stone.

Factories—Two woolen, one cotton, and several flouring mills.

Railroads—Atlantic and Pacific.

Whole number of acres in county, 520,000; number of acres cultivated, 52,000; number of acres uncultivated, 468,000; increase of cultivated acres in 1876, 3 per cent.

Winter wheat—Acreage, 5,200; average yield, 5 bushels per acre; price, 65 and 85 cents.

Corn—Acreage, 28,000; average yield, 20 bushels per acre; price, 25 cents.

Oats—Acreage, 5,200; average yield, 10 bushels per acre; price, 20 cents.

Irish potatoes—Acreage, 1,340; average yield, 150 bushels per acre; price, 20 and 30 cents.

Fruits—Acres in orchards, 200; of nurseries, 2.

Newspapers—*Cassville Democrat* and *Valley Press*.

Schools—Number of public, 70; number of private, 5; condition, good.

Churches—Ten Baptist; five Presbyterian; two Methodist; two Christian.

Granges—Seven; number of members, 800.

## BARTON COUNTY.

Face of country—Forest, per cent., 40; bottom land, per cent., 10; prairie, per cent., 80.

Timber—Number of acres, 38,000; varieties, oak, hickory and walnut.

Principal streams—North Fork of Spring river, and Horse creek.

Minerals—Coal.

Factories—One plow, two wagon, and one flour mill.

Whole number of acres in county, 380,000; number in cultivation, 88,000; number of acres not cultivated, 342,000; increase of cultivated acres in 1876, 5,000.

Wheat—Acreage, 5,000; average yield, 18 bushels per acre; price, \$1 per bushel.

Corn—Acreage, 15,000; average yield, 45 bushels per acre; price, 18 cents per bushel.

Rye—Acreage, 100; average yield, 20 bushels per acre; price, 60 cents per bushel.

Oats—Acreage, 5,000; average yield, 40 bushels per acre; price, 25 cents per bushel.

Irish potatoes—Acreage, 1,000; average yield, 100 bushels per acre; price, 60 cents per bushel.

Sweet potatoes—Acreage, 50; average yield, 40 bushels per acre; price, \$1.25 per bushel.

Flax—Acreage, 3,500; average yield, 10 bushels per acre; price, \$1 per bushel.

Castor beans—Acreage, 1,500; average yield, 15 bushels per acre; price, \$1 per bushel.

Farm animals—Number of horses, 3,150; mules, 697; sheep, 3,123; swine, 6,639; cattle, 86,881.

Dogs—Whole number in the county, too many; value, \$200.

Number of sheep killed by dogs, 50; value, \$100.

Number of stands of bees, 300; number of pounds of honey sold, 5,000; price, 20 cents per pound.

Fruits—Acres in orchards, 1,200; of nurseries, 75; vineyards, 10.

Dairy products—Number of pounds of cheese manufactured, 8,000; price, 20 cents per pound; number of pounds of butter, 60,000; price, 15 cents per pound.

Banks—J. H. Neal & Co., and C. H. Brown & Co.; capital invested, \$40,000.

Newspapers—*Lamar Independent* and *Barton County Advocate*.

Schools—Number of public, 59; number of private, 1; condition, good.

Churches—Five Congregational; thirteen Methodist; one Christian; four Baptist; eight Presbyterian; total, 25.

Granges—Five.

## BOLLINGER COUNTY.

This county was organized on the first day of March, 1851, and is situated in the southeastern part of the State. In general appearance it is broken, with fine valleys and level land on top of the hills.

The county is heavily timbered, being covered with the different kinds of oak,

hickory, maple (both hard and soft), walnut, pine, poplar, gum, cypress, sycamore and sassafras.

The county is well watered by many small rivers, creeks, etc., of which the Big and Little Whitewater, Castor river, Hog creek, Cane creek, and others may be particularly mentioned as affording ample water-power.

Iron ore is found in great abundance, some of the hills being little else but iron. Some beds of kaolin have been developed, while there are indications of silver, lead and cobalt.

The climate is mild and healthy.

The county has a population of 8,848, who devote their time principally to agricultural pursuits.

There are in the county one steam and five water flouring mills, four steam lumber mills, one stave factory, one wool-carding machine, and several blacksmith and wagon shops. There are also a few tanneries in Bollinger county, and it offers a fine opportunity for a business of that kind, there being fine locations and tan-bark in abundance.

Wheat, corn, oats and cotton are the principal productions, wheat being the principal export. The county is well adapted to the raising of fruits, etc., there being about 1,200 acres planted in orchards, 40 in nurseries and 200 in vineyards. Tobacco does well in many places.

Some attention has been paid to the introduction of improved live stock, with remarkably good results.

The St. Louis, Iron Mountain and Southern Railway runs through the county from northwest to southeast, having four stations within the county. A gravel road runs to Cape Girardeau, thus affording excellent shipping facilities.

Schools are plentiful and well appreciated.

Churches are numerous and of all denominations.

## CALDWELL COUNTY.

Face of country—Forest, per cent., 33½; bottom land, per cent., 16½; prairie, per cent., 50.

Timber—Number of acres, 92,827; varieties, six kinds of oak, walnut, elm, hickory, maple (hard and soft), cottonwood, hackberry, mulberry, sycamore and redbud.

Minerals developed—Lime.

Building material—Wood, stone and brick.

Factories—One foundry; three wagon factories; four cabinet and furniture.

Railroads—Hannibal and St. Joseph.

Whole number of acres in county, 287,480; number in cultivation, 92,827; number uncultivated, 185,654; increase of cultivated acres during the year, 14,374.

Wheat—Acreage, 7,500; average yield, 12 bushels per acre; price, 90 cents per bushel.

Corn—Acreage, 11,000; average yield, 25 bushels per acre; price, 27 cents per bushel.

Rye—Acreage, 10,000; average yield, 12 bushels per acre; price, 45 cents per bushel.  
Oats—Acreage, 10,000; average yield, 5 bushels per acre; price, 15 cents per bushel.  
Irish potatoes—Acreage, 10,000; average yield, 75 bushels per acre; price, 40 cents per bushel.

Sweet potatoes—Acreage, 1,000; average yield, 40 bushels per acre; price, 50 cents per bushel.

Timothy hay—Acreage, 11,500; average yield, 1½ tons per acre; price, \$4 per ton.

Clover hay—Acreage, 12,000; average yield, 2 tons per acre; price, \$3 per ton.

Prairie hay—Acreage, 7,500; average yield, 1 ton per acre; price, \$3 per ton.

Timothy seed—Acreage, 300; average yield, 4 bushels per acre; price, \$1.40 per bushel.

Dogs—Whole number in county, 21,000; value, \$36,000.

Number of sheep killed, 400; value, \$500.

Animal diseases—Hog-cholera; damage, \$5,000.

Fruits—Acres in orchard, 3,000; nurseries, 10; vineyards, 20.

Value of garden products sold, \$1,000; value of poultry and eggs, \$15,000.

#### CAPE GIRARDEAU COUNTY.

This county, organized March 5, 1849, is situated on the western bank of the Mississippi river, one hundred and twenty miles below St. Louis.

The surface of the county may be divided into bottom (level) and upland (rolling and hilly). The southern part contains the so-called "swamp lands," estimated at 150,000 to 175,000 acres. These low grounds are famed for their fertility. They are easily reclaimed by drainage. Along the river and creeks are also fertile bottoms, producing grains and grasses in great abundance. The uplands are rolling and in many places hilly; they are mostly excellent for the production of wheat, corn, oats, clover, etc., principally the former, as this county has long been known to produce wheat of the finest quality.

The county is well watered by many rivers, creeks and springs, some of the larger creeks affording splendid power for mills or manufactories.

The timber consists principally of oak, poplar, gum, elm, hickory, etc., and is sufficiently abundant to prove adequate to all future demands for railroad ties, fences, building purposes, and for fuel.

Some iron has been found, but no mines have been opened, and it is not known whether it exists in sufficient quantities to render the working of it remunerative. Fine marble exists in large quantities. Several deposits of ochre and kaolin are being developed; also, fine sand for glass, and clay for manufacturing earthenware.

The climate is mild and healthy.

The county contains the following manufactories: 8 steam flouring mills; 7 water flouring mills; 10 steam saw mills; 2 woolen mills; 1 foundry; 2 lime kilns; 1 soda water factory; one large distillery; one washing machine factory, and several paint mills. There are also a large number of cooper shops connected with the flouring mills.

According to the census of 1870, there were 99,131 acres of improved land, 178,619

acres of woodland, besides 381,000 acres of other unimproved land. The number of inhabitants is about 20,000.

Agriculture is the leading occupation. Hogs, neat cattle, horses, mules and sheep, are raised to a considerable extent for sale. The yield of the crop of 1876 is about as follows: Corn, 30 bushels; wheat, 20 bushels; oats, 20 bushels; rye, 20 bushels; Irish potatoes, 50 bushels; sweet potatoes, 40 bushels; sorghum, 30 gallons; red-top, timothy and clover, 1 to 1½ tons per acre.

Blue grass grows spontaneously, but neither that or any other tame grass is used to any extent for pasture; unless it be the meadow after the grass is cut. Clover is principally relied on for pasture, and is highly esteemed. The wild grasses of the woods furnish nourishment for stock, which are allowed to run loose from April to November.

#### CEDAR COUNTY.

Face of country—Forest, 66 per cent.; bottom land, 15 per cent.; prairie, 34 per cent.

Timber—Varieties, oak, hickory, hackberry, elm, etc. Number of acres in timber, 84,809.

Principal streams are the Sac river, Bear, Cedar and Horse creeks.

Minerals developed—Coal and iron.

Building material—Limestone and sandstone.

Factories—Two mills and two tanneries.

Products—Wheat, 64,850 bushels; corn, 826,238 bushels; rye, 3,980 bushels; oats, 47,954 bushels; barley, 60 bushels; tobacco, 64,609 pounds; sorghum, 20,794 gallons.

Farm animals—Number of horses, 4,727; mules, 1,226; sheep, 12,318; swine, 20,720.

Bees—Number of stands, 1,000; honey worth 12 to 15 cents a pound.

Schools—Number of public schools, 70.

#### CLAY COUNTY.

Wheat, 18 bushels per acre; corn, 30 bushels per acre; oats, complete failure, or nearly so; rye, 10 bushels per acre; barley, none raised.

Grasses—Tame, very little raised—destroyed by grasshoppers—but what was raised was quite good; mostly blue grass, of excellent quality. Prairie grass was a complete failure.

Hogs—Only about a two-thirds crop, the hog-choleera destroying about one-third; 10,000 fat hogs sold.

Cattle—The usual number raised, say 2,500 fat cattle.

Horses—Usual number raised ; mules, usual number raised.

Fruits—Apples, about one-sixth of crop—nearly a total failure ; pears, almost total failure ; peaches, almost entire failure ; small fruits, one-half crop ; grapes, a good average crop.

Potatoes—A very fair crop of potatoes raised.

The farms in our county are generally large.

Timber—About three-fourths of our county is timber land, but much of this is being cleared. No bottom land, except along Missouri river ; about 80 out of 400 square miles are bottom land.

No agricultural society in the county.

### COOPER COUNTY.

Face of country—Forest, 50 per cent. ; bottom land, 16½ per cent. ; prairie 33½ per cent.

Timber—Number of acres, 145,123 ; varieties, oak, ash, walnut, hickory and elm.

Principal streams and water power—Missouri and Saline rivers, Saline and Moniteau creeks.

Minerals developed—Coal and lead.

Factories—One woolen, one foundry, one furniture, two earthenware and cheese factories.

Railroads—Missouri, Kansas and Texas, and Osage Valley and Southern Kansas.

Market facilities—Our market facilities are very good.

Products—Winter wheat, acreage, 50,000 ; average yield, 15 bushels ; price 80 cents. Corn, acreage, 100,000 ; average yield, 30 bushels ; price, 30 cents. Rye, acreage, 600 ; average yield, 15 bushels ; price, 60 cents. Oats, acreage, 50,000 ; average yield, 20 bushels ; price, 20 cents. Irish potatoes, very few ; price, 80 cents. Sweet potatoes, good ; price, 75 cents. Tobacco, very little ; average yield, 800 pounds per acre ; price, 5 to 10 cents. Sorghum, most of it made for home use, but worth 50 cents per gallon. Millet and Hungarian, very little.

Farm animals—Number of horses, 6,035 ; mules, 2,328 ; sheep, 12,225 ; swine, 26,015.

Dogs—Whole number in county, 5,000 ; number of sheep killed by said dogs, 500 ; value of same, \$1,500.

Cholera, or lung disease, has been very destructive during the last year among swine.

Banks—Central, National and Achle Dunnica. Capital invested, \$300,000.

Newspapers—*Eagle*, *Advertiser* and *Missourian*.

Schools—Number of public, 40 ; number of private, 5 or 10 ; condition good.

Churches—A good many.

FRANKLIN COUNTY.

Face of country—Forest, 30 per cent. ; bottom land, 20 per cent.

Timber—Number of acres, 160,000 ; varieties, seven kinds of oak, hickory, walnut, pine, cottonwood, sycamore and birch.

Principal streams and water power—Meramec, Burbeuse, Bœuf, Staint, Jones and Berger rivers.

Minerals developed—Lead, iron, copper and zinc.

Building materials—Wood, stone and brick.

Railroads—Missouri Pacific, Atlantic and Pacific and Missouri River.

Whole number of acres in county, 554,143 ; number cultivated, 150,000 ; number not cultivated, 404,143 ; increase of cultivated acres, 5,000.

Wheat—Acreage, 61,871 ; average yield, 17 bushels per acre ; product, 1,057,801 bushels ; price, 90 cents per bushel.

Corn—Acreage, 50,000 ; average yield, 35 bushels per acre ; product, 1,750,000 bushels ; price, 85 cents per bushel.

Rye—Acreage, 750 ; average yield, 15 bushels per acre ; product, 2,250 bushels ; price, 55 cents per bushel.

Oats—Acreage, 20,000 ; average yield, 30 bushels per acre ; product, 1,000,000 bushels ; price, 80 cents per bushel.

Buckwheat—Acreage, 50 ; average yield, 40 bushels per acre ; product, 2,000 bushels ; price, 15 cents per bushel.

Irish potatoes—Acreage, 1,573 ; average yield, 100 bushels per acre ; product, 157,300 bushels ; price 30 cents per bushel.

Sweet potatoes—Acreage, 100 ; average yield 100 bushels per acre ; product, 10,000 bushels ; price, 95 cents per bushel.

Flax—Acreage 20 ; average yield, six bushels per acre ; product, 120 bushels ; price, 95 cents per bushel.

Tobacco—Acreage, 2,520 ; average yield, 500 pounds per acre ; product, 179,890 pounds ; price, 4 cents per pound.

Sorghum—Acreage, 50 ; average yield, 60 gallons per acre ; product, 3,000 gallons ; price, 50 cents per gallon.

Clover hay—Acreage, 1,061 ; average yield, two tons per acre ; product 2,122 tons ; price, \$8 per ton.

Timothy hay—Acreage, 6,500 ; average yield, two tons per acre ; product, 13,000 tons ; price, \$8 per ton.

Farm animals—Number of horses, 6,196 ; mules, 2,542 ; sheep, 10,494 ; swine, 27,890.

Dogs—Whole number in county, 8,630 ; value, \$5,000. Number of sheep killed by dogs, 2,000 ; value, \$4,000.

Animal diseases—Hog-cholera ; damage done by same, \$40,000.

Bees—Number of stands, 400 ; price of honey, 15 cents per pound.

Banks—Washington Savings Bank, capital, \$50,000.

Newspapers—*Observer, Record, Post and Democrat.*

Schools—Number of public, 91 ; private, 21 ; condition good.

Churches—Methodist, 16 ; Presbyterian, 18 ; Baptist, 12 ; Lutheran, 11 ; Catholic, 7 ; Christian, 2.



## GASCONADE COUNTY.

Timber—Number of acres, 270,846 ; varieties, oak, hickory, walnut, elm, sycamore, birch, cottonwood, ash and hackberry.

Principal streams are the Gasconade and Bourboise rivers, dry Fork and Red Oak creeks.

Minerals developed—Iron, lead and coal.

Building materials—Wood, sandstone, brick and limestone.

Factories—Seven saw-mills and six flouring mills.

Railroads—Missouri Pacific.

Whole number of acres in county, 820,346 ; number of acres cultivated, 50,000 ; number of uncultivated acres, 270,346 ; increase of cultivated acres in county, 8,000.

Wheat—Product, 241,335 ; average yield, 15 bushels per acre ; price 95 cents per bushel.

Corn—Product, 405,186 ; average yield, 30 bushels per acre ; price 35 cents per bushel.

Rye—Product, 2,110 ; average yield per acre, 15 bushels ; price 65 cents per bushel.

Oats—Product, 153,490 ; average yield per acre, 30 bushels ; price, 30 cents per bushel.

Barley—Product, 1,306 ; average yield, 30 bushels per acre ; price 90 cents per bushel.

Irish potatoes—Product, 30,000 bushels ; average yield, 75 bushels per acre ; price, 40 cents per bushel.

Tobacco—Product, 33,354 pounds ; average yield, 500 pounds per acre ; price 10 cents per pound.

Brandy—Product, 1,980 gallons ; average yield, 150 gallons per acre ; price \$2.50 per gallon.

Wine—Product, 65,779 gallons ; average yield, 200 gallons per acre ; price 60 cents per gallon.

Timothy hay—Product, 4,520 tons ; average yield, 1 ton per acre ; price, \$8 per ton.

Clover hay—Product, 5,502 tons ; average yield, 1½ ton per acre ; price, \$7 per ton.

Farm animals—Number of horses, 3,157 ; mules, 1,458 ; sheep, 8,167 ; swine, 17,524 ; cattle, 9,291.

Fruit—Number of acres in orchard, 1,500 ; of vineyards, 480.

Value of poultry and eggs sold, \$1,500.

Banks—Hermann Savings Bank.

Newspapers—*Gasconade Advertiser* and *Gasconade Courier*.

Schools—Number of public, 54 ; private, 13.

Churches—Eleven Lutheran ; 5 Presbyterian ; 6 Baptist ; 6 Methodist, and 3 Catholic.

## GENTRY COUNTY.

Face of Country—Forest, per cent., 33 ; prairie, per cent., 67.

Timber—Number of acres, 104,960 ; varieties, oak, walnut, elm, cottonwood, ash and locust.

Principal streams and water-power—Grand river, Panther, Muddy, Lamson and Hickory creeks.

Minerals developed—Coal.

Building material—Wood, stone and brick.

Factories—Woolen and foundry; capital, 18,000.

Whole number of acres in county, 314,880; number of acres cultivated, 78,720; number of acres uncultivated, 236,160; increase of acres cultivated, 2,089.

Wheat—Acreage, 830; average yield, 15 bushels per acre; product, 12,450; price, 90 cents per bushel.

Corn—Acreage, 52,460; average yield, 40 bushels per acre; product, 2,098,400 bushels; price 25 cents per bushel.

Rye—Acreage, 625; average yield, 20 bushels per acre; product, 13,700 bushels; price 35 cents per bushel.

Irish potatoes—Acreage, 625; average yield, 100 bushels per acre; product, 62,500; price, 40 cents per bushel.

Sorghum—Acreage, 884; average yield, 80 gallons per acre; product, 66,720 gallons; price, 50 cents per gallon.

Millet and Hungarian—Acreage, 3,336; average yield, 8 tons per acre; product 10,008 tons; price, \$3 per ton.

Timothy hay—Acreage, 1,445; average yield, 8 tons per acre; product, 4,335 tons; price, \$8 per ton.

Prairie hay—Acreage, 4,155; average yield, 2 tons per acre; product, 8,310 tons; price, \$2 per ton.

Farm animals—Number of horses, 7,606; mules, 807; sheep, 14,455; swine, 29,607.

Dogs—Whole number in county, 2,000.

Bees—Number of stands, 1,800; number of pounds of honey sold, 6,000; price 12½ cents per pound.

Fruits—Number of acres in orchard, 1,334; of nurseries, 20.

Dairy products—Number of pounds of butter, 48,000; price, 12½ cents.

Garden products—Value sold, \$1,600.

Value of eggs and poultry sold, \$1,666.

Banks—Gentry County Bank; capital invested, \$15,000.

Newspapers—Three.

Schools—Number of public, 87.

## GREENE COUNTY.

Timber—Number of acres, 328,040; varieties, oak, walnut, hickory, cherry, red-bud, sycamore and pine.

Principal streams and water-power—James, Finley, Swan and Bull creeks.

Minerals developed—Lead and zinc.

Building material—Lumber, brick, limestone, cotton rock and sandstone.

Railroads—Atlantic and Pacific.

Agricultural statistics—Whole number of acres in county, 359,040; number of acres cultivated, 36,000; number of acres uncultivated, 823,040.

Farm animals—Number of horses, 2,785 ; mules, 572 ; swine, 8,500.

Dogs—Whole number in county, 2,800 ; value, \$5,000.

Animal diseases—In horses, distemper ; in swine, some cholera.

Newspapers—*Monitor*, *Leader* and *Republican*.

Schools—Number of public, 45 ; number of private, 1.

Churches, number and denominations—Two Methodist, two Baptist, two Presbyterian, one Christian, and one Unitarian.

### GRUNDY COUNTY.

Face of country—Forest, per cent., 35 ; bottom land, per cent., 20 ; prairie, per cent., 45.

Timber—Number of acres, 60,000 ; varieties, oak, elm, hickory, maple, ash, walnut and hackberry.

Principal streams—Grand river, Honey, Coon and Muddy creeks.

Minerals developed—Coal.

Building material—Limestone and sandstone.

Factories—One woolen mill, one planing mill.

Railroads—Chicago, Rock Island and Pacific.

Whole number of acres in county, 375,000 ; number of cultivated acres, 125,000 ; number of uncultivated acres, 250,000 ; increase of cultivated acres, 12,000.

Wheat—Average yield per acre, 15 bushels ; price, 90 cents per bushel.

Corn—Average yield per acre, 35 bushels ; price, 25 cents per bushel.

Rye—Average yield per acre, 20 bushels ; price 40 cents per bushel.

Oats—Average yield per acre, 40 bushels ; price 20 cents per bushel.

Bees—Number of stands, 500 ; number of pounds of honey sold, 15,000 ; price, 25 cents per pound.

Fruits—Acres of orchard, 1,200 ; of nurseries, 30 ; vineyards, 50.

Dairy—Number of pounds of cheese manufactured, 3,000 ; price, 11 cents per pound. Butter—Number of pounds made, 5,000 ; price 20 cents.

Garden products—Value sold, \$5,000.

Value of poultry and eggs sold, \$10,000.

Banks—First National and Shanklin and Austin ; capital, \$75,000.

Libraries 1 ; number of volumes, 500.

### HARRISON COUNTY.

Face of country—Forest, per cent., 30 ; bottom land, per cent., 5 ; prairie, per cent., 65.

Timber—Number of acres, 153,600 ; varieties, oak, hickory, walnut, elm and cottonwood.

Principal streams—Grand river, East and West, Big creek.

Building material—Wood, stone and brick.

Factories—One woolen mill and five flouring mills ; capital invested, \$50,000.

Whole number of acres in the county, 460,800 ; number of acres cultivated, 87,740 ; number of acres uncultivated, 423,060 ; increase of cultivated acres, 500.

Winter wheat—Acreage, 800 ; average yield, 15 bushels per acre ; product, 12,000 ; price, \$1 per bushel.

Spring wheat—Acreage, 200 ; average yield, 10 bushels per acre ; product, 2,000 bushels ; price, 80 cents per bushel.

Corn—Acreage, 6,000 ; average yield, 30 bushels per acre ; product, 180,000 bushels ; price, 25 cents per bushel.

Rye—Acreage, 2,000 ; average yield, 15 bushels per acre ; product, 24,000 bushels ; price, 40 cents per bushel.

Buckwheat—Acreage, 100 ; average yield, 20 bushels per acre ; product, 4,000 bushels ; price 75 cents per bushel.

Oats—Acreage, 2,000 ; average yield, 35 bushels per acre ; product, 70,000 bushels ; price, 20 cents per bushel.

Irish potatoes—Acreage, 1,000 ; average yield, 60 bushels per acre ; product, 60,000 bushels ; price 50 cents per bushel.

Sweet potatoes—Acreage, 40 ; average yield, 15 bushels per acre ; product, 3,000 bushels ; price, 50 cents per bushel.

Sorghum—Acreage, 2,000 ; average yield, 70 gallons per acre ; product, 140,000 gallons ; price, 50 cents per gallon.

Millet and Hungarian—Acreage, 600 ; average yield, 2 tons per acre ; product 1,200 tons ; price, \$5 per ton.

Timothy hay—Acreage, 6,000 ; average yield, 1½ ton per acre ; product, 9,000 tons ; price, \$5 per ton.

Clover hay—Acreage, 3,000 ; average yield, 1 ton per acre ; product, 8,000 tons ; price, \$5 per ton.

Prairie hay—Acreage, 10,000 ; average yield, 1 ton per acre ; product, 10,000 tons ; price, \$5 per ton.

Timothy seed—Acreage, 4,000 ; average yield, 5 bushels per acre ; product, 20,000 bushels ; price, 50 cents per bushel.

Farm animals—Whole number of horses, 12,000 ; mules, 5,000 ; sheep, 20,000 ; swine, 25,000.

Dogs—Whole number in county, 4,000 ; value, 4,000. Number of sheep killed by dogs, 150 ; value, \$300.

Bees—Number of stands, 2,000 ; number of pounds of honey sold, 16,000 ; price 12½ cents per pound.

Fruits—Acres of orchards, 3,000 ; nurseries, 20 ; vineyards, 120.

Number of pounds of butter manufactured, 120,000 ; price, 12½ cents.

Garden products—Value of, sold, \$20,000.

Value of poultry and eggs sold, \$16,000.

Banks—Bethany Savings and Cossand's Bank ; capital, \$30,000.

Newspapers—*Republican* and *Herald*, of Bethany, and *Eagleville News*.

Schools—Number of public, 122 ; private, 3 ; condition, good.

Churches—Four Methodist, four Presbyterian, four Baptist, two Christian and one United Brethren.

## HOLT COUNTY.

Face of country—Forest, per cent., 25; bottom land, per cent., 40; prairie, per cent., 35.

Timber—Varieties, cottonwood, elm, oak and walnut.

Principal streams—Nodaway river, Big and Little Tarkies, Mill, Squaw, Kimzie, Nickol and Hickory creeks.

Minerals—Potter's-clay and water-lime.

Building material—Wood, brick and stone.

Factories—1 woolen, 1 wagon, 1 paper and twine; capital, \$35,000.

Railroads—Kansas City, St. Joseph and Council Bluffs railroad.

Winter wheat—Acreage, 8,000; average yield, 22 bushels per acre; product, 176,000 bushels; price, 90c. per bushel.

Spring wheat—Acreage, 10,000; average yield, 14 bushels per acre; product, 140,000 bushels; price, 90c. per bushel.

Corn—Acreage, 40,000; average yield, 50 bushels per acre; product, 2,000,000 bushels.

Rye—Acreage 5,000; average yield, 30 bushels per acre; product, 150,000 bushels; price, 90c. per bushel.

Oats—Acreage, 2,000; average yield, 30 bushels per acre; product, 60,000 bushels.

Barley—Acreage, 1,000; average yield, 30 bushels per acre; product, 30,000 bushels.

Buckwheat—Acreage, 50; average yield, 15 bushels per acre; product 750 bushels.

Irish potatoes—Acreage, 1,000; average yield, 75 bushels per acre; product 75,000 bushels.

Sweet potatoes—Acreage, 500; average yield, 100 bushels per acre; product, 50,000 bushels.

Hemp—Acreage, 50; average yield, 1,000 lbs. per acre; product, 50,000 lbs.

Tobacco—Acreage, 50; average yield, 1,000 lbs. per acre; product 50,000 lbs.

Broom corn—Acreage, 30; average yield, 650 lbs. per acre; product, 195,000 lbs.

Millet and Hungarian—Acreage, 4,000; average yield, 2½ tons per acre; product, 20,000 tons.

Timothy hay—Acreage, 1,000; average yield, 1½ tons per acre.

Clover hay—Acreage, 100; average yield 2 tons per acre.

Prairie hay—Acreage 50,000; average yield, 2½ tons per acre; product, 250,000 tons.

Farm animals—Number of horses, 5,780; mules, 1,326; sheep, 4,200; swine, 32,551; cattle, 17,678.

Dogs—Whole number in county, 3,000; value, \$100. Number of sheep killed by same, 300; value \$700.

Animal diseases—Hog-cholera, \$60,000 damage.

Bees—Number of stands, 2,000; number of lbs. of honey sold, 20,000; price, 20c. per lb.

Fruits—Acres in orchard, 8,000; in nurseries, 30 acres; in vineyards, 1,000.

Dairy products—Number of lbs. of cheese manufactured, 5,000; price, 20c. per lb.; number of lbs. of butter made, 100,000; price, 25c. per lb.

Garden products—Value of same sold, \$50,000. Value of poultry and eggs sold, \$50,000.

Banks—Montgomery & Morgan, and Holt County Bank of Oregon.

Newspapers—Holt County *Sentinel*, Holt County *Press*.

Schools—Number of public, 10; private, 1.

Libraries 1, number of volumes, 1,000.

## HICKORY COUNTY.

Face of country—Forest, per cent., 40; bottom land, per cent., 10; prairie, per cent., 50.

Timber—Varieties, Oak, hickory, walnut, butternut, elm, maple, sycamore and persimmon.

Principal streams—Lindley river; water power good.

Minerals developed—Lead.

Building material—Stone.

Whole number of acres in county, 363,040; number cultivated, 26,000; number uncultivated, 287,040.

Farm animals—Number of horses, 2,890; mules, 990; sheep, 5,980; swine, 4,994.

## IRON COUNTY.

Iron county is situated in the southeastern part of the State, and was organized February 17, 1857. The divide of the Ozark mountains was through the county from east to west; the surface is hilly and broken, so that not more than one-twentieth of its area is considered arable, though much of the hilly land now considered worthless, except for timber, is well adapted to the establishment of orchards and vineyards, meadows and pasturage.

The county is well watered by numerous springs and streams; the principal streams being Big creek, Stout's creek and Marble creek. The tillable land lies in narrow valleys. The soil generally consists of yellow and red clay, with numerous alluvial bottom lands.

Timber is abundant in the hills; generally white oak and pitch pine, with some walnut and hickory. In the larger valleys and for 10 or 12 miles around the iron works, the best timber has been cleared off, and a great deal of it wasted.

There are 319,879 acres of land in the county, of which nearly 100,000 are improved.

The county has three steam and five water flouring mills, two carding mills, three wagon factories, seven lumber mills, one cotton gin and mill, and one foundry and plow factory.

The county has 6,623 inhabitants, whose leading occupation is mining and agriculture.

Corn, wheat and oats are the staple crops, and not enough is raised to supply the home demand; tobacco is also raised to a considerable extent, while cotton, barley, rye, hemp, flax, etc., are all successfully grown.

Blue grass grows spontaneously; clover and timothy yield heavily; orchard grass and red-top also do well; clover and timothy are growing in favor, and are cultivated more and more every succeeding year.

Improved breeds of cattle and sheep have been introduced. Large numbers of hogs are raised. Iron county is a most excellent range for sheep, but as yet there are not more than 3,000 head of sheep in the county.

This county is well adapted to horticulture, and orchards do well. About 200 acres of land are planted in orchards, and 50 or more in vineyards.

The St. Louis, Iron Mountain and Southern Railway runs through the county north and south; the wagon roads are first class; the facilities for transportation exceed the requirements.

Iron is every where, and every variety and quality of its ores, except red hematite, which, though found in many places, has not yet been found in large bodies. There are iron mines at Pilot Knob, Sheppard's Mountain and Hogan's Mountain, with a furnace at Pilot Knob. Iron Mountain is on the east line of the county, the company running two furnaces.

A lead mine has been opened about 10 miles east of the county seat. Lead is found in many other places, but not in large quantities.

Granite and kaolin are abundant. Granite for the great bridge across the Mississippi, at St. Louis, for the State House at Springfield, Illinois, and for the custom houses at St. Louis and Cincinnati, and the water-works crib at Chicago, was quarried in this county.

Species of copper and zinc are found in every part of the county.

Perhaps fifteen hundred persons have settled in the county since the war, but a large number of them have been miners, quarrymen, stone-cutters, colliers and choppers, who come and go according to the condition of business at the iron and granite works.

Churches are numerous, and there are plenty of public schools, which are rapidly improving; the Arcadia college, now completed, is a fine building, beautifully situated.

## JASPER COUNTY.

Face of country—Forest, per cent., 15; bottom land, per cent., 15; prairie, per cent., 70.

Principal streams—Spring river, Center and North Fort creeks.

Minerals developed—Lead and zinc.

Building material—Wood.

Factories—One woolen mill, eighteen flouring mills and one foundry; capital, \$190,000.00.

Railroads—Memphis and Carthage, and St. Louis and Kansas City.

Whole number of acres in the county, 895,889; cultivated acres, 150,000; uncultivated acres, 245,339.

Farm animals—Horses, 5,000; mules, 2,000; sheep, 8,000; swine, 10,000.

Bees—Number of stands, 1,150; number of pounds of honey sold, 57,500.

Fruits—Number of acres in orchard, 1,500; of nurseries, 200; vineyards, 100.

Banks—First National Bank, Bank of Carthage, Farmers' and Drovers'.

Newspapers—Carthage *Advance*, *Banner*, *Patriot* and *Press*, and Joplin *Daily* and *Weekly News*.

Schools—Number of public, 119.

Libraries—14; number of volumes, 10,000.

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JEFFERSON COUNTY.

Face of country—Forest, per cent., 75; bottom land, per cent., 15; prairie, per cent., 10.

Timber—Varieties, oak, hickory, walnut, maple, sycamore, elm, ash, mulberry, cedar and cottonwood.

Principal streams—Meramec and Big rivers, Rock, Glayers, Sandy, Mudd Swashin and Beleures.

Minerals developed—Lead, zinc and iron.

Building material—Stone, wood and brick.

Factories—Four flouring mills, and the American Plate Glass Co.; capital invested, \$350,000.00.

Railroads—St. Louis, Iron Mountain and Southern.

Winter wheat—Product, 180,844 bushels; price, 85 cents per bushel.

Corn—Product, 578,268 bushels; price, 30 cents per bushel.

Rye—Product, 864 bushels; price, 65 cents per bushel.

Oats—Product, 7,843 bushels; price, 30 cents per bushel.

Barley—Product, 198 bushels; price, 95 cents per bushel.

Irish potatoes—Product, 95,000 bushels; price, 45 cents per bushel.

Sweet potatoes—Product, 30,000 bushels; price 75 cents per bushel.

Farm animals—Number of horses, 4,986; mules, 1,757; sheep, 6,771; swine, 24,271; cattle, 10,888.

Dogs—Whole number in county, 3,500; value, \$10,000.00.

Number of sheep killed by dogs, 400; value, \$1,000.00.

Newspapers—Jefferson County *Democrat* and *Southeastern*.

Number of public schools, 77; condition good.

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## LACLEDE COUNTY.

Face of country—Forest, per cent., 60; bottom land, per cent., 30; prairie, per cent., 10.

Timber—Varieties, burr-oak, walnut, butternut, hickory, ash, maple and elm.

Principal streams—Osage and Gasconade rivers.

Minerals developed—Iron and lead.

Building material—Brick and limestone.

Railroads—St. Louis and San Francisco R. R.

Schools—Number of public, 53; number of private, 14; condition good.

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## LIVINGSTON COUNTY.

Face of country—Forest, per cent., 30; bottom land, per cent., 20; prairie, per cent., 50.



Timber—Varieties, oak, hickory, walnut, maple, cottonwood, sycamore and elm.  
Principal streams—Grand river, Medicine and Shoal creeks.

Factories—Six flouring mills, one woolen mill and one planing mill; capital, \$125,00.

Railroads—Hannibal and St. Joseph and Chicago, Quincy and Eastern.

Farm animals—Horses, 6,622; mules, 1,442; cattle, 17,725; sheep, 10,145; swine, 17,331.

### MARION COUNTY.

Face of country—Forest, per cent., 25; bottom land, per cent., 10; prairie, per cent., 20.

Timber—Number of acres, 104,693; varieties, elm, hickory, white, burr, red and pin-oak, hard and soft maple, ash, walnut and cherry.

Principal streams and water power—North and South rivers, and the north and south Fabius rivers; also Bear creek; water power very good.

Minerals developed—Coal.

Building material—Limestone and sandstone.

Factories—Nine flouring, grist and corn mills, and one woolen mill.

Whole number of acres in county, 280,000.

Winter wheat—Product, 195,025 bushels; corn—product, 1,021,235 bushels; rye—product, 1,805 bushels; oats—product, 89,062; barley—product, 105 bushels. The price of wheat is \$1.00 per bushel; of corn, 40 cents; oats, 25 cents.

Farm animals—Number of horses, 6,716; mules, 1,597; sheep, 9,493; swine, 32,160; cattle, 16,072.

Dogs—Whole number in county, 1,600, and are worth nothing.

Number of sheep killed by dogs, 100; value, \$400.00.

Hog-cholera prevailed to a considerable extent.

Banks—Marion County Savings, First National Bank, of Hannibal, Farmers' and Merchants', of Hannibal, and First National Bank, of Palmyra.

Newspapers—Hannibal *Courier*, daily and weekly; Hannibal *Clipper*, daily and weekly; Marion County *Democrat* and Palmyra *Spectator*.

Schools—Number of public, 62; number of private, 8; condition good.

Churches—Number and denomination: Methodist, 13; Baptist, 11; Presbyterian 9; Christian, 6; Lutheran, 3; Congregational, 2; Catholic, 2; O. S. Baptists, 2; total, 49.

Libraries—One.

Number of granges, 8; number of members, 700.

### MCDONALD COUNTY.

Face of country—Forest, per cent., 60; bottom land, per cent., 30; prairie, per cent., 10.

Timber—Varieties, hickory, pine, oak, walnut, ash, elm, maple and sycamore.

Principal streams—Elk river, Big and Little creeks.

Minerals developed—Lead.

Building material—Limestone.

Whole number of acres in the county, 352,988 ; number of cultivated, 28,244 ; number uncultivated, 324,584.

Farm animals—Number of horses, 2,410 ; mules, 649 ; sheep, 6,332 ; swine, 9,572.

Newspapers—*Princeville News*.

### MISSISSIPPI COUNTY.

This county is situated in the southeastern part of the State, opposite the mouth of the Ohio river, and was organized February 14, 1845.

The surface of the county is level, being almost entirely composed of bottom land, and is, with the exception of a few prairies, heavily timbered, principally with oak of all kinds, cypress, walnut, gum, pecan, sycamore, cottonwood, cherry etc. The soil is rich, warm and easily cultivated.

The county is almost entirely surrounded by the Mississippi river, and has also the James Bayou running through its center, rendering the county susceptible of easy drainage.

No minerals, excepting bog iron, have been found in this county. Brick clay is found in abundance, so that the want of rock is comparatively little felt.

The manufactories of this county are two flouring mills, one planing mill, sash and door factory and a wagon factory.

Within the limits of the county, there are 253,440 acres of land, of which 68,440 acres are in a state of cultivation. The acreage of improved land has increased some 3,000 acres during the past year.

The county has a population of about 6,000 souls, who are chiefly engaged in agriculture.

Corn, wheat and cotton are the leading productions ; cotton is cultivated successfully, yielding from 400 to 600 pounds per acre ; tobacco grows very heavy ; while sorghum yields 100 gallons per acre ; tame grasses are not cultivated to any extent, there being excellent natural pasturages.

Large numbers of hogs are raised both for home consumption and export.

Sheep do well, but are destroyed by dogs to such an extent as to discourage the farmers from trying to raise them. All fruits do well, except cherries and plums ; while vegetables and melons of all kinds are extensively raised for market.

The facilities for reaching market are excellent, the St. Louis, Iron Mountain and Southern Railways running through the county from the northwest to the southeast, and a branch of the same road passes through the northern part of the county. In addition, there is the Mississippi river, bordering on the east side of the county, which is a good outlet for all kinds of produce.

Churches and schools are excellent, and in a flourishing condition.

## NODAWAY COUNTY.

Face of country—Forest, per cent., 25; bottom land, per cent., 25; prairie, per cent., 50.

Timber—Number of acres, 139,772; varieties, oak, hickory, walnut, elm, maple, basswood and sycamore.

Rivers—Nodaway and Platte are the principal streams.

Minerals developed—Coal.

Building material—Sandstone, limestone and brick.

Factories—1 woolen, 10 flouring and 8 sawmills, 1 sash and door, and 5 waggon factories.

Railroads—Kansas City, St. Joseph and Council Bluffs.

Whole number of acres in county, 559,057; number of acres cultivated, 127,000; number of acres uncultivated, 432,051; increase of cultivated acres, 17,000.

Winter wheat—Acreage, 9,786; average yield, 15 bushels per acre; product, 146,814; price, 90 cents per bushel.

Spring wheat—Acreage, 3,500; average yield, 5 bushels per acre; product, 17,500; price, 40 cents per bushel.

Corn—Acreage, 58,000; average yield, 40 bushels per acre; product, 2,320,000; price, 20 cents per bushel.

Rye—Acreage, 900; average yield, 17 bushels per acre; product, 15,300; price, 40 cents per bushel.

Oats—Acreage, 10,000; average yield, 10 bushels per acre; product, 100,000; price, 20 cents per bushel.

Barley—Acreage, 7,000; average yield, 20 bushels per acre; product, 140,000; price, 50 cents per bushel.

Buckwheat—Acreage, 176; average yield, 15 bushels per acre; product, 2,600; price, 40 cents per bushel.

Irish potatoes—Acreage, 8,000; average yield, 70 bushels per acre; product, 560,000; price, 25 cents per bushel.

Sweet potatoes—Acreage, 40; average yield, 75 bushels per acre; product, 28,000; price, 50 cents per bushel.

Tobacco—Acreage, 8; average yield, 700 pounds per acre; product, 5,600 pounds; price, 10 cents per pound.

Broom corn—Acreage, 13; average yield, 400 pounds per acre; product, 5,200 pounds; price, 3 cents per pound.

Sorghum—Acreage, 115; average yield, 200 gallons per acre; product, 23,000; price, 50 cents per gallon.

Millet and Hungarian—Acreage, 2,000; average yield, 1½ ton per acre; product, 3,000 tons; price, \$4.00 per ton.

Timothy hay—Acreage, 8,000; average yield, 2 tons per acre; product, 6,000 tons; price, \$6.00 per ton.

Clover hay—Acreage, 1,000; average yield, 2 tons per acre; product, 2,000 tons; price, \$5.00 per ton.

Prairie hay—Acreage, 23,362; average yield, 2 tons per acre; product, 47,724 tons; price, \$2.50 per ton.

Timothy seed—Acreage, 100; average yield, 5 bushels per acre; product, 500 bushels; price, \$2.75 per bushel.

Farm animals—Horses, 10,888; mules, 1,472; sheep, 11,875; swine, 54,000.

Dogs—Whole number in county, 7,000; value \$30,000.00; number of sheep killed by dogs, 360; value, \$900.50.

Animal diseases—Hog-cholera, \$13,500.00 damage.

Bees—Number of stands, 1,168; number of pounds of honey sold, 50,000; price, 25 cents per pound.

Fruits—Number of acres in orchard, 900; in nurseries, 85; in vineyards, 7.

Dairy product—Number of pounds of cheese manufactured, 1,500; price, 10 cents per pound; number of pounds butter made, 375,000; price, 15 cents per pound.

Garden products—Value of sold, \$500.00; value of poultry and eggs sold, \$15,000.00.

Banks—Nodaway Valley, Fisher, Jackson & Co., Hopkins and Baker; capital \$150,000.

Newspapers—Nodaway *Democrat*; Marysville *Republican*, and Hopkins *Journal*.

Schools—Number of public, 142; private, 2; condition good.

Churches—Methodist, 10; Christian, 4; Presbyterian 5; Catholic, 2; Baptist, 2.

Libraries—2, public; number of volumes, 450.

Granges—13; 1 farmer's club.

#### PLATTE COUNTY.

Crops—Wheat, 40 bushels per acre; corn, 30 bushels per acre; oats very poor; rye, large crop.

Farm animals—Horses, not many raised; mules, not many raised; cattle, good crop; swine, about half the usual crop.

Animal diseases—Hog-cholera did some damage.

Potatoes—An average crop.

One Agricultural Society; Asa L. Smith, Secretary.

#### RANDOLPH COUNTY.

Face of country—Forest, per cent., 50; bottom land, per cent., 20; prairie, per cent., 30.

Timber—Number of acres, 100,000; varieties, oak, hickory, maple, ash, birch and elm.

Principal streams—East Fork river, and Flat and Sugar creeks.

Minerals developed—Coal and potter's clay.

Building material—Limestone and sandstone.

Factories—1 woolen mill; 2 flouring mills; and 12 tobacco factories.

Railroads—St. Louis, Kansas City and Northern; and Missouri, Kansas and Texas.

Whole number of acres in county, 396,877 ; number of acres cultivated, 168,579 ; number of acres uncultivated, 188,088 ; increase of cultivated acres during the year, 16,000.

Wheat—Acreage, 300 ; average yield, 10 bushels per acre ; product, 3,000 bushels ; price, \$1.25 per bushel.

Corn—Acreage, 51,112 ; average yield, 25 bushels per acre ; product, 1,277,800 bushels ; price, 25 cents per bushel.

Rye—Acreage, 400 ; average yield, 12 bushels per acre ; product, 4,800 bushels ; price, 50 cents per bushel.

Oats—Acreage, 20,000 ; average yield, 20 bushels per acre ; product, 400,000 bushels ; price, 25 cents per bushel.

Irish potatoes—Acreage, 2,500 ; average yield, 50 bushels per acre ; product, 27,500 bushels ; price, 25 cents per bushel.

Tobacco—Acreage, 7,500 ; average yield, 800 pounds per acre ; product, 6,000,000 pounds ; price, 5 cents per pound.

Sorghum—Acreage, 200 ; average yield, 30 gallons per acre ; product, 6,000 gallons ; price, 50 cents per gallon.

Timothy hay—Acreage, 17,097 ; average yield, 2 tons per acre ; product, 35,094 tons ; price, \$5.00 per ton.

Clover hay—Acreage, 1,700 ; average yield, 2½ tons per acre ; product, 4,250 tons ; price, \$3.00 per ton.

Farm animals—Number of horses, 7,050 ; mules, 3,267 ; sheep, 14,180 ; swine, 14,850.

Dogs—Whole number in county, 6,000 ; value, nothing ; number of sheep killed by dogs, 2,000 ; value, \$6,000.

Fruits—Acres in orchard, 200 ; in nurseries, 40 ; vineyards, 10.

Dairy products—Number of pounds of cheese manufactured, 210,000 ; price, 20 cents per pound ; number of pounds of butter manufactured, 200,000 ; price, 20 cents per pound.

Banks—Huntsville Savings, Mechanics' Savings, and Avery & Woolfrefk ; capital, \$150,000.00.

Newspapers—Huntsville *Herald*, Moberly *Enterprise-Monitor*, (Daily,) and Moberly *Headlight* (Weekly).

Schools—Number of public, 75 ; private, 4 ; condition good.

## RIPLEY COUNTY.

Face of country—Forest, per cent., 90 ; bottom land, per cent., 10.

Timber—Number of acres, 895,000 ; varieties : pine, oak, walnut, hickory, ash and gum.

Principal streams—Current and Little Black rivers ; Harris, Logan, Buffalo and Big Barren creeks.

Building material—Wood and brick.

Whole number of acres in the county, 420,000 ; number of acres cultivated, 25,000 ; number of acres uncultivated, 395,000 ; increase of cultivated acres, 200.

Products—Wheat, 9,877 bushels; corn, 173,643 bushels; rye, 192 bushels; oats, 18,944 bushels; barley, 7 bushels; cotton, 24,000 pounds; tobacco, 57,741 pounds; sorghum, 15,741 gallons; hay, 814 tons.

Farm animals—Number of horses, 1,849; mules, 416; sheep, 3,513; swine, 8,378; cattle, 8,981.

Fruits—Number of acres in orchard, 1,000; in vineyards, 7.

### SALINE COUNTY.

Minerals developed—Coal and lead.

Building material—Wood and stone.

Factories—One woolen, 2 carding, and 2 flouring mills.

Railroads—Sedalia and Lexington Railroad.

Winter wheat—Average yield, 15 to 25 bushels per acre; product, 176,996 bushels; price, \$1 to \$1.10.

Corn—Average yield, 15 to 25 bushels per acre; product, 5,845,965 bushels.

Oats—Product, 220,950 bushels; price, 30 cents per bushel.

Sorghum—Product, 31,127 gallons; price, 50 cents per gallon.

Timothy hay—Product, 13,567 tons; price, \$4 per ton.

Farm animals—Number of horses, 10,498; mules, 6,601; sheep, 11,037; swine, 34,937; cattle, 20,166.

Banks—Bank of Missouri, Saline County Bank, Wood & Huston. Capital, \$730,000.

### SCOTT COUNTY.

This county is situated on the Mississippi river, in the southeastern part of the State. It was organized from a part of New Madrid county, December 28, 1821.

A little more than one-half of the surface of this county is level or nearly so, and four-fifths of this portion is extremely fertile, producing corn, cotton, wheat and all the grasses, and is also well adapted to the growth of peaches and other fruits. More than one-third of the surface, and principally the northern part, is high and rolling, but not too steep to be susceptible of cultivation; nearly one-half of this hill-land lies well for agricultural purposes.

The principal streams are the East Fork of White Water, which forms a part of the western boundary, and its tributary, Caney creek, in the northwestern part of the county, while the Mississippi river forms its eastern boundary. In the south-central part is the St. John bayou.

The soil is, generally, most excellent for farming, and especially so in the Mississippi bottoms, which extend from three to five miles back from the river.

The county has a great variety of timber, chiefly the white, red and black oak, walnut, beech, elm, sweet gum, cypress, hackberry, etc. Sassafras often grows large enough to make twenty-four rails to the cut. Formerly nearly the entire surface of the county was covered with forests, and there is now enough left for all practical purposes.

Of minerals, we must mention the apparently inexhaustible mines of yellow ochre, an excellent mineral paint, and worked profitably to some extent at present. In the northeastern part of the county are fine quarries of white marble and limestone easily converted into lime. Iron and lead ore are thought to exist in the hills, while bog iron is found extensively in the swamps.

Manufacturing interests are represented by one steam flouring mill, with cooper shop attached; two steam stave factories, one pottery, one lime-kiln, several ochre grinding machines, and nine steam saw-mills.

The county contains 262,464 acres of land, of which 52,493 acres are improved; the balance, 209,971 acres, consist of unimproved and timber lands. About 62,000 acres of land are owned by Hon. Thomas Allen, who has placed it on the market at low rates, and most favorable terms. The greater portion of it is very fertile.

The leading occupation of the 10,000 inhabitants is agriculture. The chief productions are wheat, corn, oats, barley, cotton, tobacco, potatoes and fruit. They all yield excellent average crops.

The exports are principally wheat, oats, corn, cotton, staves, lumber, ochre, hogs and cattle.

This county is well adapted to the growth of tame grasses. Timothy yields generally from 3,500 to 4,000 pounds per acre. Blue grass does well in nearly all parts of the county. Clover is beginning to be grown extensively and yields about three tons to the acre.

Farmers have only of late turned their attention to stock-raising, although this is one of the best counties in the State for this purpose. Quite a number of hogs are marketed annually. There are also most excellent ranges for sheep.

Some parts of the county are well adapted to fruit culture, and farmers are just beginning to make it profitable, and young orchards are springing up everywhere; there now being about 1,500 acres of land planted in orchards.

The facilities for transportation are the Mississippi river, the St. Louis, Iron Mountain and Southern Railway, passing directly through the centre of the county from northwest to southeast; one railroad passing near the southern border, and a third on the northern border, well advanced and sure of completion.

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### STODDARD COUNTY.

Stoddard county is situated in the southeastern part of the State, and was organized January 2, 1835.

The surface of the county is very diversified. The uplands, constituting about one-third of the whole area, and which are situated in about the middle of the county from north and south, are mostly rolling, with a clay loam, underlaid with a yellow or reddish sandy or gravelly clay, very fertile, well supplied with springs, and splendidly adapted for farming. A narrow strip of prairie occurs in the southern part of the county. The bottom lands are mostly level—some rolling—covered with a dense growth of timber, and have a very deep, sandy, alluvial soil, very productive, and are principally covered with cottonwood, hickory, sycamore, maple, cypress, etc. The county contains some of the so-called swamp-lands, probably named thus because they

are almost always dry, only in very wet seasons is this term applicable; but they are very easily drained. On some of these "lakes and swamps," which are so persistently located in this county, many of the finest farms are found.

The Castor river, with its fertile banks, is the principal river, running through the county from northwest to southeast, and furnishing excellent water-power. Many other smaller streams meander through it, which, with the immense number of fine springs, furnish all the necessary water for farm use.

The surface of the county being almost entirely covered with timber, there can be no possible lack of it for present or future demands.

The manufactories of the county embrace ten mills—seven with steam-power, of which four are flouring and grist-mills, and three saw-mills; seven cotton gins and three wool-carding machines.

The mineral resources are not developed, but the county possesses large quantities of various minerals, such as iron, lead, zinc, nickel, copper, plumbago, ochre, kaolin, barytes, silver, etc., brown hematite of iron, bog or limonite iron ore and lead are prevalent.

The price of land is very low.

The leading occupation of the 10,888 inhabitants is agriculture; and the principal staples are cotton, wheat, corn, oats, peanuts, tobacco, hogs, hides, etc. The lands are unsurpassed, and the yields are very large. Tobacco of excellent quality is grown to quite a large extent; the product of 1876 being 248,948 pounds. Sorghum and peanuts are grown profitably.

Few of the tame grasses are cultivated, the excellent free range rendering it unnecessary.

Quite a number of mules, cattle and hogs are sold annually, while improved breeds of animals are being rapidly introduced.

All kinds of fruits flourish and produce excellent crops.

The Cairo and Poplar Bluff Division of the St. Louis, Iron Mountain and Southern Railway, furnishes ample means of transportation, and is bringing in many settlers.

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## TEXAS.

The wheat crop in this county is badly injured by hard dry freezing. There will not be more than half a crop. There have been but two good snows, and neither lay very long.

Farmers do not keep large flocks of sheep on account of dogs and wolves.

Corn and cattle-raising are the chief occupation.

Horses are being raised to some extent.

Hogs are coming into notice; Berkshires are the favorite.

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## WASHINGTON.

Timber—Number of acres, 111,795; varieties: Pine, several of the different kinds of oak, hickory, walnut, ash and elm.



Principal streams—Big river, Renault, Mineral and Indian creeks.

Minerals developed—Lead, iron and zinc.

Building material—Wood and limestone.

Factories—1 cheese, and 2 tanneries.

Railroads—St. Louis, Iron Mountain and Southern.

Whole number of acres in county, 442,360; number of acres cultivated, 22,118; increase during the year, 6 per cent.

Number of farm animals—Horses, 2,853; mules, 1,094; sheep, 4,770; swine, 5,952.

Animal diseases—Hog-cholera did about \$2,000 damage.

Bees—Number of stands, 200; number of pounds of honey sold, 5,000; price, 25 cents a pound.

Dairy products—Number of pounds of cheese manufactured, 30,000; price 12½ cents per pound.

Newspapers—Washington County *Independent*.

Churches—10 Presbyterian; 7 Congregational; 4 Catholic; 12 Methodist; and 8 Baptist.

Granges, 8; members, 260.

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**PROCEEDINGS**  
**OF THE**  
**MISSOURI**  
**STATE HORTICULTURAL SOCIETY,**  
**AT ITS**  
**EIGHTEENTH ANNUAL SESSION,**  
**HELD AT**  
**KANSAS CITY, ON THE 19TH, 20TH, 21ST AND 22D OF DECEMBER, 1876.**

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# MEMBERS OF MISSOURI STATE HORTICULTURAL SOCIETY

## FOR 1877.

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### LIFE MEMBERS.

Henry T. Mudd .....	Kirkwood, Mo.
H. Clagett .....	Gray's Summit, Mo.
D. L. Hall .....	Kansas City, Mo.
A. E. Trabue .....	Kansas City, Mo.
Rev. Chas. Peabody .....	Chicago, Ill.

### ANNUAL MEMBERS.

I. M. Ridge .....	Kansas City, Mo.
W. H. Hopkins .....	Kansas City, Mo.
J. M. Slocum .....	Kansas City, Mo.
Wm. E. Sheffield .....	Kansas City, Mo.
Frank Holsinger .....	Kansas City, Mo.
William Mustard .....	Kansas City, Mo.
G. T. Espenlamb .....	Kansas City, Mo.
L. A. Garrett .....	Kansas City, Mo.
J. M. Greenwood .....	Kansas City, Mo.
A. M. Allen .....	Kansas City, Mo.
A. G. Trumbull .....	Kansas City, Mo.
Z. S. Ragan .....	Independence, Mo.
Milton Vernon .....	Independence, Mo.
H. M. Vall .....	Independence, Mo.
W. G. McBride .....	Independence, Mo.
A. Proctor .....	Independence, Mo.
H. T. Kelsey .....	St. Joseph, Mo.
Jacob Madinger .....	St. Joseph, Mo.
J. A. Storm .....	St. Joseph, Mo.
Wm. Stark .....	Louisiana, Mo.
W. Foster .....	Louisiana, Mo.
S. S. Laws .....	Columbia, Mo.
G. C. Swallow .....	Columbia, Mo.
J. C. Evans .....	Harlem, Clay county, Mo.
Z. Todd .....	Harlem, Clay county, Mo.
Chas. V. Riley .....	St. Louis, Mo.
R. J. Lewis .....	Westport, Mo.
A. W. St. John .....	Carthage, Mo.
Jno. B. Durand .....	Prairie City, Bates county, Mo.
C. G. Wilcox .....	Wyandotte, Kansas.

# LIST OF MEMBERS OF MISSOURI STATE HORTICULTURAL SOCIETY

WHO PAID DUES FOR 1876.

---

J. C. Evans .....	Kansas City, Mo.
John Monteith .....	St. Louis, Mo.
C. J. Peleter.....	St. Louis, Mo.
F. F. Fine.....	St. Louis, Mo.
T. W. Guy.....	Kimswick, Mo.
W. M. King .....	St. Louis, Mo.
Ernest Olshousen.....	St. Louis, Mo.
Jacob Rhodes .....	Bridgeton, Mo.
E. O. Filley .....	St. Louis, Mo.
J. M. Samuels.....	St. Louis, Mo.
W. C. Flagg.....	Moro, Ills.
Charles C. Keeler .....	Cincinnati, Ohio.
J. M. Jordan .....	St. Louis, Mo.
Isidor Bush.....	Bushberg, Mo.
J. K. Keller.....	Pittsfield, Ills.
W. F. Hikes.....	Dayton, Ohio.
A. J. Long... ..	Sappington, Mo.
Henry Bruihl.....	Appleton, Mo.
T. R. Allen.....	Allenton, Mo.
Wm. T. Essex.....	St. Louis, Mo.
L. D. Votaw.....	Eureka, Mo.
A. J. Childs .....	Independence, Mo.
J. C. Gill .....	Leroy.
J. S. Parsons .....	Miami.
J. P. Bibb .....	Huntsville.
W. W. Henderson.....	Bridgeton, Mo.
Isaac Snediker .....	Jerseyville, Ills.
Fred. Hayden.....	Alton, Ills.
Jona. Huggins .....	Woodburn, Ills.
J. W. Averitt.....	Macomb, Ills.
Robt. Watson .....	Lee's Summit, Mo.
W. H. Miller.....	Chillicothe, Mo.
German Farmers' Club.....	Amazonia, Mo.
Geo. A. Martin.....	Buffalo, N. Y.
J. I. Thomson.....	Walker, Vernon county, Mo.
Sugar Grove Grange .....	Clay county, Mo.
K. Coates .....	Kansas City, Mo.
T. S. Case.....	Kansas City, Mo.
Samuel Miller.....	Bluffton, Mo.
H. T. Kelsey.....	St. Joseph, Mo.

**LIST OF OFFICERS**  
**OF THE**  
**MISSOURI STATE HORTICULTURAL SOCIETY FOR 1877.**

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**PRESIDENT :**  
**J. C. EVANS, Harlem, Clay County, Mo.**

**TREASURER :**  
**CHAS. V. RILEY, St. Louis, Mo.**

**SECRETARY :**  
**R. J. LEWIS, Westport, Mo.**

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**STANDING COMMITTEES FOR 1877.**

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**BUSINESS :**  
**GEO. HUSMANN, Sedalia,                      T. W. GUY, Kimswick,**  
**WM. E. SHEFFIELD, Kansas City.**

**FLOWERS :**  
**L. A. GOODMAN, Westport,              WILLIAM MUNGER, St. Joseph,**  
**HENRY MICHAEL, St. Louis.**

**VEGETABLES**  
**L. E. BOSLEY, Kansas City,              J. A. STORM, St. Joseph,**  
**F. F. FINE, St. Louis.**

**VINEYARDS :**  
**SAMUEL MILLER, Sedalia,              J. MADINGER, St. Joseph,**  
**H. CLAGGETT, Gray's Summit.**

**ENTOMOLOGY AND ORNITHOLOGY :**  
**C. V. RILEY, St. Louis,              F. WHOLRINGER, Kansas City.**

**ORNAMENTAL TREES :**  
**G. C. SWALLOW, Columbia,              GEORGE HUSMANN, Sedalia.**

**AGRICULTURAL COLLEGE :**  
**WM. E. SHEFFIELD, Kansas City,      WILLIAM STARK, Louisiana.**

**ORCHARDS :**  
**Z. TODD, Harlem,              W. A. ST. JOHN, Carthage.**

**SMALL FRUITS :**  
**SAMUEL MILLER, Sedalia,              W. M. HOPKINS, Kansas City.**

PROCEEDINGS  
OF THE  
MISSOURI STATE HORTICULTURAL SOCIETY,  
AT ITS  
EIGHTEENTH ANNUAL SESSION,  
HELD AT  
KANSAS CITY, MO., DECEMBER 19, 20, 21 AND 22, 1876.

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The meeting was held in accordance with a circular issued by the President and Secretary.

The meeting was called to order at 2 P. M., in the Law Equity court-room, at Kansas City, by J. C. Evans of Harlem, President. In the absence of the Secretary, Wm. M. King of St. Louis, D. L. Hall of Kansas City, was elected Secretary *pro tem*.

Col. D. S. Twitchell, of Kansas City, made an eloquent address of welcome in behalf of the citizens of Kansas City. This was responded to in behalf of the Society by D. C. Hall, who briefly referred to the pleasant and profitable meeting held by the Society in Kansas City in 1871; also to the depression that horticulture had suffered since that time in common with all other pursuits, during which time, however, the Society had not failed to hold their regular annual meeting. He alluded to the fine display of fruit on the table as an evidence that Missouri was pre-eminently a fruit-growing State, and the Missouri State Horticultural Society could and would, had they been allowed the appropriation made to them by the Legislature in 1870, have been able to make a showing at the Centennial at least equal to any other State. It was to be hoped that the discussions of this meeting would be of permanent value to the horticulturist, not only of Missouri, but of the entire West; and from an intimate acquaintance with the meetings and reports of the Society for the past ten years, he was prepared to state, without fear of contradiction, that for practical value to horticulturists they were not surpassed by those of any horticultural society. Finally, as a member of the Society, and in their name, he thanked the citizens of Kansas City for their hos-

pitalities, now twice extended, while, as a citizen of Kansas City, he felt proud that Kansas City should have been the only place in the State, outside of St. Louis, twice selected as the place of the meeting of the Society.

The President, J. C. Evans, then read his annual address :

#### PRESIDENT'S ADDRESS.

*Ladies and gentlemen of the Missouri State Horticultural Society :*

Let us return the gratitude of our hearts to the Supreme Ruler of the Universe that we are permitted to meet together in this the Eighteenth Annual Session of this Society. The history of this Society down to the Thirteenth Annual Session has been so well given by Hon. Henry T. Mudd and others, that it is not necessary for me to go beyond that. Many who are present to-day, doubtless, remember with pleasure the meeting held in this city five years ago. Since that time this Society has met once at Jefferson City, once at Hannibal, and twice in the city of St. Louis ; and while these meetings have been both interesting and instructive, we must admit they have not been just what the meetings of this Society should be. We are aware that only those who were directly interested have been benefited, while the masses have neither directly or indirectly felt any effects resulting therefrom. When we take into account that every interest in the land has been prostrate during most of this time, we conclude we have a good excuse for not having done more ; and, again, when we look about us and see what our sister States have done and how well their horticultural interests have been represented at the various meetings of the National Pomological Society, and this year at our great Centennial Exposition, while our State—our *own proud* Missouri—has scarcely been heard from, we must conclude something is wrong. We inquire what it is, and we find in almost every other State, especially in the West, ample appropriations have been made by their legislatures, and committees raised and sent on to these places fully prepared to represent their interests, while we have been constantly refused such aid. I would recommend that steps be taken to get our next General Assembly to do something for us in this direction.

About 1869 or 1870, an act was passed by our Legislature, giving to this Society one thousand dollars annually, but by some means the word annually was rubbed out, and we never received anything after the first year. Now, if we could have this word annually replaced, it seems to me it would be about what we want, and would enable us to represent the horticultural interests of our State as they should be. My opinion is, that a few thousand dollars, judiciously expended in the exhibition of our products at these annual meetings in the Eastern States and the results published to the world, would attract emigration and benefit the State ten fold.

I have perhaps said more on this subject than I need to, as we are expecting something from our Centennial Committee ; but I consider the matter of so much importance that we cannot say too much. Let us keep on talking and acting until we have accomplished our purposes, and are able to show to the world that our State is second to none in this great family in point of horticulture.

At the last meeting of this Society a resolution was adopted authorizing the offering of small premiums for collections of fruits, flowers, etc. In compliance with that resolution, premiums to the amount of sixty dollars have been offered, to be awarded at this meeting. Some fears have been entertained as to the propriety of this course in the face of the almost total failure of the fruit crop, to say nothing of the various other causes likely to operate against such a course. But if it proves only a partial success this year, we will then know that under favorable circumstances it can be made an entire success, and will add largely to the interest and value of our meetings. So let us



go onward and upward, until we have made this Society something that our State will be proud of, and that they who come after us will say we have not lived in vain.

I am here reminded that a name dear to us has dropped from our list as an active member. I allude to that zealous and useful brother, O. H. P. Lear, of Hannibal, Mo.

At the conclusion of this paper, Mr. Z. S. Ragan, of Independence, stated that the allusion to the death of Hon. O. H. P. Lear, during the past year, called to mind the loss of another old and valued member and ex-President, who had passed away during the year; he alluded to the late Henry M. Vorhies, Judge of the Supreme Court of the State. In him the Society had sustained a great loss. 'He it was who first started the Society out of its old rut of meeting in St. Louis year after year, and induced them to hold meetings elsewhere; first at his own home, in St. Joseph, and afterwards in Kansas City, Jefferson City and elsewhere. He moved the appointment of a committee to draft suitable resolutions in memory of the late distinguished President and Vice President, Vorhies and Lear.

Mr. D. L. Hall seconded the resolution, stating that to Henry M. Vorhies the Society was largely indebted. During his Presidency of two years, the Society had accomplished some of its most valuable work. Mr. Lear had also proved a most indefatigable worker and true friend, both of the Society and of horticulture, and those who had attended the meeting of the Society at Hannibal would bear witness to his kindness, energy and unbounded hospitality.

The motion was adopted, and Messrs. Ragan, Foster and Kelsey appointed as the committee.

The following report, from the regular Secretary, Mr. M. King, was then read :

# ANNUAL REPORT OF THE SECRETARY.

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*Mr. President and Members of the Missouri State Horticultural Society :*

Since our last annual meeting, with two exceptions, the horticulturists of this and the surrounding States have reason to congratulate themselves upon the favorable conditions which have surrounded their growing crops.

The winter of 1875-6 was favorable, when viewed from a horticultural standpoint. The prospects in the Missouri and Mississippi Valleys was perhaps never more favorable for a full and abundant crop than they were up to the 15th of March. In a letter written from Kingston, Caldwell county, Missouri, dated March 20th, it is stated that previous to that date some farmers had commenced plowing, but that there was a heavy fall of snow on the night of the 16th, followed by freezing weather. On the same date the Secretary of the Missouri Valley Horticultural Society wrote from Kansas City as follows: "We have just had one of the most severe snow storms of the season; wind east and northeast, which, however, changed to the northwest the next morning, when the thermometer fell to two degrees above zero." At Hillsboro, Jefferson county, four inches of snow was reported, while the thermometer indicated seventeen degrees at 9 A. M. At Ripley, Tennessee, the coldest weather ever known there, after the middle of March, was reported, and on the night of the 19th inst., eight inches of snow fell, and ice formed to a thickness of one and one-half inches. The peach, plum and cherry trees were in full bloom, and these fruits were all destroyed. At Milburn, Kentucky, on the night of the 19th inst., snow fell to the depth of ten inches, and at six o'clock A. M., the 20th inst., the mercury stood at nine degrees, and the following day at twenty-one above zero. Peaches and other fruits in bloom were all killed, and the blossoms looked as if they had been scorched by fire. From Beebe and Austin, Arkansas, similar reports were received. In the great fruit-growing region of Southern Illinois, at Cobden, on the same date, the mercury sank to ten degrees above zero. The result was that the entire peach crop was cut off, as well as pears, such as the Duchess Louise Bonne, and a few other varieties. None of the apples were injured, except the Red Astrachan. The calamity was a very general one; but here and there could be found a fruit-grower who was disposed to joke, and sought consolation in the fact that for once the Curculio had been outgeneraled. Fortunately there was a limit, beyond and north of which the trees had not yet blossomed, and there the peaches and other fruits escaped destruction. If this line could be accurately located, it would furnish some interesting data, which might be made of service to horticulturists.

The northern boundary of the section where the fruit was destroyed seems to have been, as near as may be, the south line of Pike, Greene and Morgan counties in Illinois, and the south line of Pike, Ralls and Monroe counties in this State; the southern

boundary included, I think, Shreveport, Vicksburg and Nashville. At all events, the area of territory which was visited by this untimely frost was equal in extent to at least five States as large as Missouri. A record of this is made (imperfect as it is), so that when a similar visitation occurs, the lesson taught by this one may not be without its value to horticulturists.

### UTILIZING FRUITS.

Notwithstanding the continued increase of acreage planted to orchards and small fruits, it must be admitted that the consumers of horticultural products do not find a superabundance of first class canned or dried fruit in the market at any season of the year. That there is a vast amount of wasteful and unintelligent management in the handling of fruit, there is no doubt. The greatest loss to the fruit-grower, it must be admitted, results from the large quantities of defective fruit, which annually goes to waste. It is therefore important that a reform in this particular should be inaugurated among the orchardists throughout the State without delay.

As to the best method of utilizing the fruits that would otherwise be wasted, it is generally conceded that *drying* is the best. One advantage in marketing dried fruit is, that when properly dried and packed, it can be kept for one year or more, if need be, and put upon the market at the most favorable time. But it is not enough that *fruit drying* establishments should be erected, for, in many localities, it will be found advantageous to carry on *canning* as well. By combining *both* methods of taking care of the surplus products of the orchard and small fruit plantations, fruit-growing can be made profitable.

If any community expects to make fruit-growing a success, they should sell from their fields when it pays, and when it does not, drying or canning should be resorted to. The objection will be urged that these fruit-drying and canning establishments require more capital to erect them and carry them on than any one person cares to invest. The most feasible plan therefore seems to be, a co-operative or joint stock plan. Nothing should deter the members of one or more granges in the fruit-growing districts from starting canning and drying factories.

Another means of utilizing, or rather realizing a greater profit than is now realized from the sale of long keeping varieties of fruits, is the erection of more fruit preserving houses. It is a well known fact that selected, carefully handled fruit, can be placed in *fruit-houses*, and instead of being sold in the fall for \$2.00 a barrel, it can be kept until spring, with a trifling loss, perhaps, and sell readily from \$4.25 to \$10.00 per barrel. The profit in thus keeping the fruit is so great, and the usual charge for storing it is so small, it is quite evident that in the apple-growing districts contiguous to Kansas City and other cities, having a population of ten thousand or more inhabitants, such fruit-houses would prove not only profitable to the orchardist, but equally so to the capitalist or to the members of a joint stock or co-operative association. Mr. Keeler of Cincinnati, in his admirable report on utilizing fruits, which was read at our last annual meeting, very tersely states the importance of putting such fruits as would be likely to spoil into the best possible condition for the market. He says:

"The intelligent merchant sells his wares in the best market within his reach, and at the time that his customers need them; if, from any cause, the available markets are overstocked, he ceases to urge sales, knowing that it is better to wait than to sell at a loss; the time soon comes when the balance of trade is readjusted, and when he can sell at remunerative prices. The orchardist can conduct his business in the same manner and with the same profitable results, provided he will avail himself of the same

advantages offered him as the results of the experience and skill of others. The rules for success may be stated in a few words: never overstock the market: never sell when customers do not want to buy. This involves the necessity of, in seasons of abundance, only sending to market a portion of the fruit crop in a green condition, and of being able to hold the remainder for days, weeks or years."

### CO-OPERATIVE EFFORT NECESSARY FOR THE DESTRUCTION OF NOXIOUS INSECTS.

Co-operative effort need not, nor should it be exclusively confined to the enterprise alluded to. There is necessity of co-operative effort in the destruction of noxious insects, such as the codling moth, curculio, etc. As the necessity of co-operative effort in the destruction of the Rocky Mountain Locust has become as apparent, and there is such a disposition on the part of farmers to combine together against their common enemy, it may serve as an important lesson, and show how easily fruit-growers could combine for destroying noxious insects. It must be admitted that it is discouraging in the highest degree for *one* fruit grower to wage an unceasing warfare on noxious insects, which some neighbor, by reason of his carelessness, is unwittingly engaged in propagating by hundreds of thousands.

### OUR DUTY AS HORTICULTURISTS.

It is clearly our duty as members of this Society, and as earnest, sensible, practical men, to place ourselves on record in a way that will show we are determined to make *an annual collection of facts* bearing upon the noble pursuit in which we are engaged. If a complete record of horticultural facts could be compiled annually, it would ultimately be a guide in pointing out a better, that is to say, the most profitable way of conducting our business as fruit-growers. All admit that a vast amount of valuable experience and information is lost annually by reason of an insufficient amount of care and system in the collection of facts. To carry out such a plan, let us resolve to enter upon the work, and, while regarding it as a duty, let us supplement our resolutions by energetic action. A great drawback to our progress as horticulturists has been that no detailed or historical statement of facts has been annually recorded. One of the great needs of the hour is some permanent system of placing upon record facts bearing upon such questions as have a direct pecuniary value to the horticulturist. The plan for effecting such a result, which was presented to this Society at its last annual meeting by Mr. Wm. Muir (the Secretary), in his interesting and valuable report, and which was reported upon favorably by a committee, of which the President of the Society was chairman, seems to be everything that can be desired.

The plan, as submitted, is for each individual to prepare a full and correct description of his lands, with the trees, etc., planted, the mode of treatment, details of experiments in course, and any information deemed desirable. Let a copy be put into the hands of the secretary of the local or State Society, and a duplicate deposited among the records of the Agricultural College. There duly entered in a proper set of books, we would have a complete view of horticulture as it is at any given time, with all the facts in the case. In this manner, and perhaps by the aid of a Curator of Horticulture, as an *attache* of the college, we would have, at all times, a complete horticultural survey of the State, and a fund of invaluable details as to soils, conditions, etc., be preserved for future reference, that are now being lost for want of record. In our short

lives, but few of the results of our experiments are demonstrated. We are merely supplied with the blanks, our successors must fill them up; let us see that all are preserved.

The addresses of the President and Secretary were then referred to a committee consisting of Messrs. Lewis, Miller and Stark.

Mr. W. M. Hopkins then read the following report from the Committee on Orchards:

#### REPORT OF THE COMMITTEE ON ORCHARDS.

*Mr. President and Gentlemen of the Missouri State Horticultural Society:*

Your Committee on Orchards beg leave to make the following report:

The past year has been almost an entire failure in standard fruits in Western Missouri, thereby causing great disappointment again to the fruit-grower, who, after losing the crop of 1875 by the grasshopper invasion, hoped for a good crop in 1876. The last winter being a very mild one, caused the fruit-buds to push forward so much that the cold snap in March (the coldest of the season) ruined the peach crop and injured all early varieties of the apple, and, in fact, winter varieties suffered more or less, and the finishing stroke came with the codling moth and all of the insect creation known to prey upon the apple. The few that escaped made very fine specimens, and were the wonder and praise of every one at our Exposition.

The cultivation of the pear in this section may be considered a failure, until a remedy can be found out for blight. We judge that about three-fourths of all the pear trees set in Western Missouri in the last eight years are all gone. The varieties least injured are Duchess, Seckel and Lawrence.

The cherry crop was a light one, in consequence of late frosts and excessive rain while in bloom. Early Richmond and Morello do the best. Sweet cherries are a failure, being too tender and short-lived.

All kinds of plums were a failure.

The quince does not succeed well here; it blights nearly as bad as the pear.

All fruit trees this season have made a good growth of wood and a fine show of fruit buds, and have gone into winter quarters in first-rate condition. The peach having nothing to do but make wood-growth and fruit-buds, has a large surplus of well-developed, well-ripened fruit-buds, and although too early in the season to give anything like a correct and reliable opinion upon a general fruit crop the coming season, the promise and outlook at the present time are quite encouraging. Apprehensions are felt by some that Mr. Hopper, on his homeward bound flight to his native home next summer, may camp and forage on us a few days, and destroy our fruit crops again. Will Prof. Riley give us his views on the apprehended danger?

The varieties of apples best adapted to this section are, for summer, Early Harvest, Red June and Red Astrachan; fall, Maiden's Blush, Mother, Rambo, Porter, Fulton, Westfield, Seek-no-Further; winter, Ben Davis, Winesap, Janet, Gilpin and Pennock. Jonathan and Grimes' Golden promise well; Lawver not sufficiently tested yet.

Peaches—Hale's Early, Troth's Early, Old Mixon, Stump-the-World, Ward's Late, Smock Free and Heath Cling. Fruit-growers have generally come to the wise conclusion to set fewer varieties than heretofore, and to discard such as will not pay or do not succeed in their localities. The pioneer fruit-growers in Missouri have had an uphill business in trying to raise their old Eastern favorite varieties, but have generally failed. Their experience is worth much to the new beginner.

The question is frequently discussed among fruit-growers, is fruit-growing a suc-

cess, or will it pay? If the experience of the last two seasons is to be the rule, the question is already solved. But, on the other hand, if the specimens shown at our fairs and the recent exhibition of the State of Kansas at Philadelphia, are to be taken as an index, the question is a debatable one. If fruit-growers expect to succeed, they may as well face the music at once and go to studying Entomology, so they can destroy and counteract the great army of insects that are upon us. And yet when we ask a small sum from our law-makers to extend the labors and usefulness of our Society, and to sustain our Entomologist in his able efforts in behalf of agriculture and horticulture, they derisively call our Society a one-horse concern and our Entomologist a "Bug-Catcher." The remedy is in the hands of the people, and if they do not apply it, they must suffer the consequences.

Our county has been overrun with tree-peddlers from certain nurseries in Ohio this fall, and, strange to say, found many victims. They represent their stock as superior to anything grown in the West, selling two-year old apple trees at twenty-five cents each by the hundred, because, as they say, grafted on foreign stocks; plum trees at two dollars each, curculio-proof. These chaps ought to be prosecuted for obtaining money under false pretenses. Buy your fruit-trees of some reliable nurseryman, as near home as you can obtain them. If all persons contemplating setting fruit trees would become members of our local societies, or even consult those that are members, they would save money and great disappointment when their trees come into bearing. We would, therefore, in conclusion, warn all against the itinerant tree-peddler.

It was moved and carried that the report be placed on file and published with the proceedings; and the President announced that the subject matter of the report was before the Society for discussion.

Mr. Hall: I would like to hear from members as to the decrease of insects during the past two years in the district overrun by the grasshoppers in 1874-5. It has been frequently stated that there has been a marked decrease, among others by Prof. Riley; and my own observation leads me to think such is the case.

Mr. Ragan: There were certainly less insects than usual during the past two years. This is especially noticeable among the native or common grasshoppers, which formerly did much damage in my fruit plantations, and are now very scarce—hardly noticeable.

Mr. Lewis thought there was little, if any, diminution in numbers; had been plenty to sting a large proportion of the fruit. The canker-worm has been very abundant this year in many localities.

Mr. Mustard thought there are less insects, especially native grasshoppers.

Mr. Ragan: The canker-worm is very local in its ravages. One orchard will be very much damaged, while the next one will be untouched, and so on, in spots over a neighborhood or county.

Mr. Holsinger thought the canker-worm to be dreaded. If proper measures are not taken in time, it will spread westward in such numbers as to destroy whole orchards, as it has done in the eastern States.

Mr. St. John: We have been about as much afflicted with insects as usual. The locust, or Rocky Mountain grasshopper, has also again visited us this fall, and we fear great damage from him next spring. We have also been troubled with an insect that attacks the young fruit of the strawberry vines, and has done us much damage.

Mr. Evans is certain that the insects destructive to fruit are not as numerous as heretofore. Had they been, with the light fruit crops of the past two years, there would have been none left after the insects had got through.

It was then suggested that as Professor Riley would be with the Society to-morrow, the discussion on insects be laid over until that time.

Mr. Todd, from the Committee on Orchards, then read the following paper :

### REPORT FROM COMMITTEE ON ORCHARDS.

*Mr. President and Members of the Missouri State Horticultural Society :*

In the year of 1876 we have again realized the fact that there is nothing certain in horticultural more than other pursuits in life. Failure and disappointment is written everywhere.

In this locality the apple trees bloomed and set a fair crop of fruit; but from atmospheric causes, or the ravages of insects, continued to drop the entire season. At maturity there were but few good specimens; in some varieties not a fair specimen to be found; yet there has been a fair growth in the tree, and no blight during the past summer; and the trees have gone into winter in good condition, the wood being well ripened and full of fruit-buds. I am more fully convinced than ever, that the trees need some cultivation.

The pear crop, as usual, is a failure, although the trees seem to have suffered less from blight than at other seasons, and have gone into winter in good condition.

Peaches—The seedling trees, in favorable localities, gave us some fruit. We also had some few specimens of budded fruit. The trees seem to have made fair growth, and gone into winter in good condition, with buds uninjured up to date.

Cherries bloomed full, but owing to cold and other causes, we cannot report more than one-fourth crop.

Plums, as usual, were a failure.

DECEMBER 19, 1876.

The paper was received and ordered published.

The Society then adjourned until 9 o'clock A. M., next morning.

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## SECOND DAY.

MORNING SESSION—WEDNESDAY, DECEMBER 20, 1876.

The meeting was called to order by President Evans, at 9 o'clock A. M.

Minutes of yesterday's meeting read and approved.

Mr. C. V. Riley, Treasurer, made a report of the financial affairs of the Society, as follows :

## TREASURER'S REPORT.

C. V. RILEY, *in account with Missouri State Horticultural Society.*

1876.		DR.	CR.
January 15..	To subscriptions received from predecessor.....		\$19 00
	To subscriptions received from January 15th, up to date.....		12 00
			<hr/> \$31 00
January 15..	By bill of Sherman Spencer.....	\$11 00	
	By postage paid by William King.....	70	
	To balance.....	19 30	
		<hr/> \$31 00	<hr/> \$31 00

In submitting the above statement of receipts and disbursements, I would remark that I have prepared a list of all those who have paid their annual subscription for 1876, and are in good standing membership. Also that ten dollars obtained for subscriptions, at the last annual meeting, were retained by Mr. Wm. Muir, who was acting as Secretary.

I find that the following names of members who paid their dues at the last annual meeting are omitted from the printed list in the Society's report: J. M. Jordon, Isidor Bush, J. K. Keller, W. T. Hikes, A. J. Long, Henry Bruhl, T. R. Allen and Wm. T. Essex. Further, that I have received no dues for Mr. H. W. Leffingwell, whose name is on that list. In this connection I would also advise that a list not only of the life members but of the honorary members be published each year with our proceedings.

I would also state that I have outstanding bills in hand to the amount of \$27, and if there is any way for the Society to recover the indebtedness of ex-treasurer Tice, or of getting an annual appropriation from the Legislature, I would recommend that active steps be taken to accomplish both ends.

Bills presented, bills ordered paid, and all other papers accompany this report.

Respectfully submitted.

C. V. RILEY.

St. Louis, Mo., December 20, 1876.

The report was referred to a committee composed of Messrs. Lewis, Hopkins and Bayles.

The same committee was also instructed to report upon all bills presented.

Mr. Hussman made a report as Vice-President. He said that in his vicinity (Sedalia, Pettis county,) the fruit crop was below an average. Apples, a very small crop; peaches, budded varieties, scarcely any; seedlings, fair; few pears cultivated and much blight among them, probably owing to the extremely wet season of 1875; cherries, Early Richmond, a good crop and a few Gov. Wood and Napoleon; strawberries and raspberries nearly average; blackberries more than average; grapes, Concord and Martha, a good crop—some rot, but not much—in the river counties the rot was very severe; less insects than usual, especially grasshoppers.

Mr. Jacob Madinger, from the Committee on Vineyards, made the following report;

St. Joseph, Mo., December 15, 1876.

*Mr. President and Members of State Horticultural Society:*

DEAR SIRS: I offer a report of vineyards and the crops of 1876 in the vicinity of



St. Joseph, which was real good, considering the circumstances, namely the grasshoppers.

The Concord, in the spring of 1876, promised a big crop, but got less every day towards ripening, and in some places rotted so severely that there was only half a crop gathered. It is my opinion that the sooner we discard the Concord the better for us grape-growers, as we have so many better varieties to take its place.

Catawba did much better than for years, where the vines were taken care of and not overloaded with fruit; there ripened the finest crop of grapes I ever saw, and the wood for next years' bearing is really fine. In some instances, where vines were not properly pruned, the vines had a solid mass of grapes, but did not ripen well. The wine thereof promises to be the best ever made.

Perkins' also did well. They bore an immense crop of grapes, great clusters; ripens early and remains on the vine well. I have gathered 200 pounds off of five vines. This I sold at ten cents, wholesale. Though they are a little foxy, but admired by many.

Göthe looked well in the spring, but mildewed some.

Martha did well; older vines much better than young ones, bearing a large crop, and did not rot.

Telegraph, after ten years' trial, promised to be very valuable for early market, being a great bearer, compact bunches, ripens as early as the Hartford, hangs well to the vine and of much better quality than the Hartford.

Hartford also did well, better than they have for years.

Senasqua is very promising; after four years bearing it proves to be very productive, excellent quality; wine made of it is really the finest we have tasted in this country. It is also an excellent table grape.

Croton is a little tender, and not for general culture; however, it is very good.

Triumph, true to the name, for the first time bearing, it did fine—bunches large and fine.

Black Eagle, for the first time bearing, promises well, very productive, bunches long, excellent quality; if hardy, a good substitute for the Concord. It is 50 per cent. better and fully as good a bearer.

Elvira would have borne last year, but it was grasshoppered, and, in consequence, had little bearing-wood, but bore an immense crop of compact, small bunches, and is, undoubtedly, a very valuable addition to our list of grapes.

Virginia Seedling did fine, considering the circumstances. The vines were cut down by the grasshoppers and did not have much bearing-wood.

Ives' and Rentz are great growers, and hardy vines, and good bearers. The fruit is only second rate.

Rogers' Nos. 4, 8, 9 and 15 have lost their foliage and mildewed some.

Eumalan rotted some. What was left was fine.

Iona did better than it did for four years, ripening a large crop and large bunches of superior grapes.

The wood I got for Cambridge, after two years' nursing, turned out to be a full-blooded *Concord*.

I have a good many others, but wish to give them a fair trial before reporting.

Our vineyards are in a splendid condition, fine wood, and, if nothing happens, we will have the finest harvest next year we have ever had.

Yours, etc.,

JACOB MADINGER.

The paper was received and ordered filed.

Mr. Husmann, being called upon, said he was satisfied that in the *Elvira*, in the

grapes alluded to in the report, and a seedling raised in Missouri, by Jacob Rommel, of Hermann, we had the coming grape; it has now borne seven years, and always abundant crops, and every year perfectly healthy, both in vine and fruit. On it the success of grape-growing in Missouri depends. I visited the vineyards of Hermann this year; the rot was terrible; whole acres with not enough grapes to be worth gathering—Concord, Martha and other varieties all equally bad, or nearly so. Among this desolation, some thirty vines of the *Elvira*, on Mr. Rommel's place, were a sight to behold; immense quantity of fine fruit, and perfectly healthy, a delicious table grape, first-rate for wine, and a strong, healthy leaf and cane. Mr. Rommel deserves great credit for his patient and careful effort with this and other seedlings, of which he has many good ones yet unnamed.

Mr. Stark, being called on for his report as Vice President, promised to present one later in session.

Mr. Garrett, of Jackson county, then read the following paper:

#### PROPAGATION AND CULTURE OF THE RASPBERRY AND BLACKBERRY IN WESTERN MISSOURI

I shall speak only of the Blackcap variety of raspberry, as I have no practical knowledge of any other.

Propagation is natural and from tips, but may be multiplied by laying the vines, but not recommended. Planting should be done early in the spring, on ground thoroughly prepared. Rows should stand seven feet apart, and the plants four feet in the row. When the plants have reached a height of eight inches, they should be pinched back. The following spring, prune back well, and cultivate thoroughly, and when the young canes grow to the height of about twenty inches, pinch out the crown, and let the laterals grow throughout the season, as a second manipulation will be injurious. I find that all the Blackcap varieties require about the same conditions and treatment, and are all improved by high cultivation.

There are new varieties being introduced that bid fair to succeed; prominent among them the Thwack, a red raspberry, and propagated from suckers, bids fair to rival the best.

Blackberries have hardly proved to be worthy of cultivation in this section. Would prefer to give its place to something more worthy and profitable. The ease and certainty with which most small fruits are grown, should encourage the thousands of our people who rarely enjoy the luxury of these luscious fruits, to engage in their cultivation.

The paper was received, and placed before the Society for discussion.

Mr. Hall: Do I understand the author to recommend the abandonment of blackberry culture for market?

Mr. Garrett: That is my recommendation.

Mr. Hall: Then I decidedly dissent from the recommendation; am confident that by the majority of growers and consumers the blackberry will be preferred to the raspberry. It is a better canning fruit—better for canning and preserving; is liked, by some at least, better as a table berry, and will bear more bushels to the acre, and fill a quart-box in much less time. We cannot do without it. The blackberry vines came up nicely after the grasshopper raid, where the raspberries were almost totally destroyed.

Mr. Sheffield: We certainly cannot afford to let go of the blackberry. I esteem it one of the very best of our small fruits, both for present and winter use; would prefer to do without the raspberry first.

Mr. Hopkins does not think very much of the blackberry as a market fruit ; is not nearly so certain, profitable, hardy, nor of as easy culture as the Blackcap raspberry, but still would not give it up altogether.

Mr. Salisbury considers the blackberry one of the most profitable small fruits ; has had a good crop four years out of five ; has largely increased his plantation within the past two years.

Mr. Todd : My experience with the blackberry was very favorable ; under favorable circumstances, no fruit pays better ; knew of one case where 8,800 quarts were picked from three-quarters of an acre, and marketed at eighteen cents per quart in Kansas City. What shall we plant to beat this ?

Mr. St. John : There is no small fruit more profitable than the Kittatinny blackberry in Southwest Missouri.

Mr. Stark would certainly not discard the blackberry ; could not get along without it. Kittatinny is the most valuable variety ; more hardy than the Lawton. Among raspberries, the Doolittle is earlier, but will not yield with the Mammoth Cluster or Miami.

Mr. Bennett agrees with the paper of Mr. Garrett. In the main, it don't pay to raise blackberries ; has tried it several years, and given them up. Would not cut off raspberry canes at less than three feet high ; they must be kept in rigorous growing condition to succeed.

Mr. Ragan : My experience is different, although my place is only three-fourths of a mile from Mr. Bennett's ; with me the blackberry is twice as profitable, with only one-half the care ; bear full crops about every other year.

Mr. Wilcox, (Wyandotte county, Kansas) : Consider the blackberry one of our most valuable fruits. Would not discard the Lawton ; it carries well, better than any other berry ; has shipped them each year to Denver, a distance of 600 miles, when no other berry would reach there in good order. Have tried all the new and old varieties of blackberries and raspberries. Miami and Mammoth Cluster are separate varieties ; Miami continues in bearing longer, and is the most valuable. Clarke is worthless. Philadelphia pays well some years, with extra care. Turner is the best red raspberry in quality, and promises well. Has had a good crop of blackberries every year but one in seven years. My next neighbor, Judd, succeeds well with the Philadelphia. We both have some Lawton blackberries every year.

Mr. Foster : Would not increase the distance between the rows of either raspberry or blackberry ; 5x5 feet is plenty of room for either ; for successful cultivation of either, the ground must be shaded by the plants. Would not, on any account, discard the blackberry. The Thwack is the best raspberry in flavor, and is hardier and will stand transportation better than any other berry.

Mr. Stark : The Kittatinny will not ship as well as the Lawton. Turner raspberry is good, but too soft. Thwack is a good berry ; has more firmness, and will ship better than any other berry.

A motion to file the paper of Mr. Garrett for publication, with the discussion thereon, was carried.

Prof. Riley, State Entomologist, then made a most interesting report on the Entomological progress of the year, keeping the attention of the Society until the close of the session ; but as his remarks will appear in full in his annual report, they are omitted here.

The Society then adjourned until 2 p. m.

## AFTERNOON SESSION.

The Society came to order at 2 P. M.

Mr. Geo. Husmann, of Sedalia, read an interesting paper on "Ornamental Tree Planting."

It was moved and carried that the paper be received with the thanks of the Society, and be published with the proceedings.

In reply to a question from a member, Mr. Husmann said the best time to trim evergreens was in June.

Prof. Riley warned the Society against recommending the Soft or Silver Maple. It is more subject than any other shade tree to the attacks of the Flat-headed Borer, and is at best a short-lived tree. He also thought that the cheapest and best way for the farmer to raise trees was from the seed.

Prof. Swallow said the Soft Maple only grew naturally in situations where its roots can reach water.

Mr. Sheffield did not consider the Soft Maple a good shade tree—was short-lived, subject to insect attacks, and so brittle that it was always more or less mutilated by the winds.

Mr. Blair thought the Soft Maple, properly grown, one of our most valuable trees; could not get along without it; should not be trimmed up until it has reached a fair size, then it will not be attacked by the Borer.

Prof. Riley recommended the Ailanthus as a handsome, fast-growing tree, less subject to insects than almost any other, and especially adapted to cities. If the female trees only are planted, there will be no disagreeable smell; this only comes from the flowers or pollen of the male tree.

The Catalpa was strongly recommended by Messrs. Sheffield, Riley and Husmann, as a strong, rapid grower, valuable for timber and generally hardy.

Prof. Swallow said that the trunks of Catalpa trees of large size destroyed in New Madrid county by the earthquake of 1811, were still in good condition, and were used by the people of that part of the State as more durable than living timber. It is the most durable of timbers and grows to a very large size. Some of the trees referred to are over ninety feet high and six feet in diameter.

Mr. Ragan spoke of a Catalpa log bridging a stream in Indiana that was nearly or quite one hundred years old, and still sound.

was moved and carried that the Society hold an evening session at 7 P. M.

Also, that Dr. Laws be requested to address the Society at 7 P. M., to-morrow evening.

The Society then proceeded to elect

## OFFICERS FOR 1877,

Resulting as follows:

PRESIDENT—J. C. Evans, Clay county.

VICE-PRESIDENTS:

*First District*—F. F. Fine.

*Second District*—J. M. Jordan.

*Third District*—Jacob Rhodes.

*Fourth District*—Joseph C. Wallace.

*Fifth District*—T. W. Guy.

*Sixth District*—M. J. Roundtree.

*Seventh District*—George Husmann.

*Eighth District*—Daniel Carpenter.

*Ninth District*—J. A. Storm.

*Tenth District*—L. Salisbury.

*Eleventh District*—George C. Swallow.

*Twelfth District*—Jamison Hawkins.

*Thirteenth District*—William Stark.

SECRETARY—R. J. Lewis, Jackson county.

TREASURER—C. V. Riley, St. Louis county.

The Secretary then read the following paper and communication from Dr. John A. Warder, President of the Ohio Horticultural Society:

*To my friends, members of the Missouri Horticultural Society, greeting for the 19th of December, 1876:*

You have asked me to send you a paper upon "*Hybridizing, and the best methods of producing new varieties of fruits, vegetables, and so forth.*"

Perhaps the proposition has been acceded to without sufficient consideration by one who is always willing to contribute his mite upon such occasions as this; for, after a careful review of the subject, he fears you will find that the *mite* of information he may be able to offer upon this subject must needs be infinitely small.

He has nothing especially new to offer to those who are already familiar with the current literature of *hybridizing*, and he must, therefore, content himself and endeavor to satisfy you with a simple review of the present state of popular belief upon this topic, and, at the same time, he may venture to expose some fallacies that have obtained currency with the people.

#### HYBRIDIZING.

Let us endeavor to set out with a correct understanding of the terms to be employed in this discussion, and ask—in what does Hybridizing consist?

A hybrid, whether a plant or animal, is a mule, the progeny of one *species* impregnated by another. A hybrid is therefore a mongrel, and it should partake of the peculiarities of each species, which is usually found to be the case; while, at the same time, it is generally observed that the new creation, if a true mule or hybrid, has no power of continuing its kind, or at best, this power is very much restricted, and exists in a direct ratio to the degree of relationship of the parents. Of these mules we have frequent illustrations among our domesticated animals, though such monstrosities rarely occur in nature.

The limits of hybridizing are found to be very narrow, it occurs chiefly between allied *species*, rarely between *genera*, and the relationship between the parents must bring them, whether plants or animals, into the same natural family or *order*. But even here, hybridizing is ever the exception, not the rule, which provides that "*like shall beget like,*" and we often find that species of a given genus, and those apparently very closely related, cannot be forced to unite in such a way as to produce hybrids; this is true of *Pyrus malus* and *Pyrus communis*; nor can either of these species fertilize the nearly allied *Cydonia* which was formerly ranked as another *Pyrus*; all of these, however, may be intergrafted with a degree of success; the union of the wood fibers is usually more or less imperfect, to be sure, and in many cases the cells of either portion appear to be simply in a state of coaptation to those of the other, without any true union of parts.

You are asked to excuse this digression, which, however, has introduced the horticultural practice of bringing together, in one plant, the parts of different species and genera, and is therefore cognate. Like hybridizing, this process also has very narrow limits, and can only be successfully effected when a certain affinity exists. This is remarkably illustrated in the propagation of the new Japan maples, which have attracted such universal admiration, owing to the diversity of form and coloration of their beautiful foliage. The Japanese are wonderful horticulturists, from whom we have much to learn. They are very successful grafters, and thus they multiply specimens and perpetuate many accidental variations, for which, indeed, they seem to be ever on the look-out.

When the first plants of these maples were imported into the United States, our gardeners noticed that they were all grafted, and without waiting for the seed from which to increase the stock, attempts were made to work them upon our native kinds, but all efforts proved abortive, the stocks of American species were "uncongenial." After a while one of the Japanese plants threw up a sucker from below the graft, when it was discovered that the *Acer polymorphum* had been used, and the hint was followed up by a large importation of the stocks from the far off land. It has since appeared that all these varied forms are simply bud-sports of this well-named species, which is indeed protean in the diversity of form and colors of its foliage. In this case it appears that the limits of grafting are confined to the species itself and to its variations.

A great deal has been said and written upon the subject of hybrids among plants, when the speakers and writers must have had reference to *crosses*, which are not necessarily, indeed very rarely are they *hybrids*; this is because the strict definition has not been adhered to.

Crossing is a very common result among cultivated plants that are nearly allied. It may result from human interference, when the skillful propagator, with great care, removes the anthers from his flowers before they have perfected their pollen grains, protects the flowers thus prepared from the access of pollen of adjacent blossoms that might be brought to the pistil by insects or in the air, until he has himself supplied the pollen from the variety or *species* he may desire to use as the impregnator, thus he expects to effect a cross of the two, and in the latter case, using a different species, he may succeed in the production of a genuine *hybrid*.

In most cases the results of cross-fertilization, whether they be natural or artificial, are merely crosses and not hybrids. In this, however, they are just as useful and equally interesting, and, by persevering and judicious efforts, with some remarkably lucky hits, and with a vast amount of weeding out, or selection of what we consider the *fittest* for our purposes, it is true, we may have obtained great improvements in our fruits, vegetables and grains.

Reference has been made to *natural crosses* in contradistinction to those produced by artificial impregnation. These may be more frequent than is generally believed, and many of the superior seedling varieties of our fruits, whose origin has been referred to natural variation, may really be owing to cross fertilization.

This process may, and probably does occur very frequently without man's aid, and it may result from contiguity of the different varieties, from the diffusion of the pollen by the winds, or, still more probably, the pollen is carried by insects, whose agency in some flowers appears absolutely essential to their fertilization. The entomologists tell us that bees, and perhaps some other insects, frequent, during the day, the particular kind of flowers upon which they had begun to pasture in the morning—in this way the pollen which adheres to their hairs may be distributed upon the pistils of other flowers of the same species, and crosses are liable to occur constantly, while in-and-in breeding,

supposed to be injurious with animals, is to a considerable extent prevented. Indian corn would seem to be necessarily crossed by the neighboring plants and seldom self-fertilized, hence the endless varieties in cultivation.

### THE BUD AND SEED.

The intimate relations and strong functional resemblances between these two parts of a plant, apparently very different, have been pointed out by Dr. Harvey, a devoted English botanist and naturalist. He clearly demonstrates how the latter, in strict accordance with the laws of morphology, may be and is derived from the former, the seed from the bud. And further he shows that each is the elemental condition or form of the future plant, or if you can accept it, each is in itself a plant. You are all familiar with the fact that the seed, when committed to the soil under favorable conditions, will germinate and become a fully developed vegetable organism. Gardeners are equally familiar with the fact that a bud will develop roots and shoots so as to form a new plant, when placed in the soil, or even when carefully joined to the tissues of a living plant of analogous character, as by budding, inarching, or by some of the various modes of grafting.

Dr. Harvey even goes so far as to call each bud a plant, and the tree he considers a community of buds or plants. This subject is introduced upon the present occasion because of the not infrequent occurrence of remarkable variations in the character of outgrowths from certain buds, which are permanent and as distinct as the varieties produced from seed, whether these be "accidental," (of unknown) origin, or the result of the most careful cross-fertilization. These varieties are known as *bud sports*, and may be cited as one of the means of adding to our lists of varieties, though they may not always be an improvement, according to our notions of excellence, and often indeed they are quite otherwise.

Another kind of sport has frequently been mistaken for the result of the crossing of different varieties. This consists in some slight modification of certain characters of little consequence, such as the form and color of the foliage and fruits. Specimens of the latter are of frequent occurrence, and they generally consist in some deterioration of the cuticle or outer skin, so that the surface of the fruit, instead of having its normal lustre and color, assumes a partially rusty appearance. This is usually attributed to the influence of the pollen from a russet apple or pear having fertilized the blossom, and the specimen is put in evidence to support the theory, but an expert at once detects the fallacy. He knows very well that the color characters are not of high value, and by the sum of the other indices he is able to recognize the variety and place the fruit where it rightfully belongs, declaring it to be a sport or casual variation; but he does not expect such a variation to be permanent, nor a fit subject for propagation, even were its multiplication desirable.

Having referred to the bud, it may be well to mention some remarkable statements as to modifications in the characters of fruits which are claimed to be the result of a forced combination of halved buds taken from different varieties. This may be called *double-budding*. For a long time the proposition was ridiculed and declared by practical grafters to be impossible. At the same time, when we examine the fruits put forward and claimed to have had such a double-headed parentage, and especially that from the so-called *sweet and sour* apple tree, which has been considered a cross between two varieties of different flavors, each being represented by alternate segments of the fruit, we find that the sour portions are acid, and resemble in flavor and appearance the Rhode Island Greening, while the intervening segments, or *sulcations*, for these parts,

as you must have observed, are undeveloped, they are not sweet, but simply flavorless and without character—immature and nearly tasteless.

There are still many persons who believe that a simple bud may be bi-sected and united with the half-bud of another variety, and that these, so combined, may be made to grow, if inserted upon a suitable stock; and moreover, that the shoot produced from these united half-buds must and will partake of the nature of each parent in all its parts, so that when the fruit comes to be developed, it too will partake of their united qualities.

When at Philadelphia last spring, this matter was discussed at some length with my friend, Thomas Meehan, the well-known horticultural writer and botanist, who is also a good observer. Mr. Meehan is a firm believer in the practicability of such a union being effected, and in the probability that the desired result of a combination of the properties of both varieties in the resultant fruits. His faith was so great that he had tried the experiment and showed us the outgrowth from such a combination-bud, which he affirmed possessed the characters of both its parents.

That there have been, and may again be, true hybrid plants as well as crosses, nobody will deny; but in the case of the former, the uncertainty of the true limit and definition of a *species* must greatly add to our difficulties. The systematic classification of plants and animals, though based upon natural characters, is still a human invention, and hence it is necessarily defective. The masters of natural history of to-day are overturning and casting aside the dicta agreed upon by the masters of yesterday, and just now it is the fashion to reduce, rather than to multiply the lists of species—so that unions that were formerly considered hybrids now become reduced to the rank of mere crosses.

To return to the main proposition—*hybridizing and the best means of producing new varieties*, it must be admitted that wonderful results have been obtained in cases where true hybridizing is claimed, as between grapes of different species. The so-called Rogers' hybrids, we are assured, were produced by crossing the foreign *vitis vinifera* upon the native *vitis labrusca*. Many other crosses of varieties of the same two species have been presented, and other native species have been used.

Our friend G. W. Campbell of Delaware, Ohio, has been unremitting in his efforts to produce crosses between the species, and has experimented by commingling them in various ways, using one and another variety as the mother-plant. Among his numerous seedlings thus produced are some of great promise. His hopes are set forth in a report to the Ohio Horticultural Society, and may be found on page 75 of the brochure for 1874 and 1875, the eighth annual:

"I have heretofore expressed the opinion that the time would come when we should have grapes of American origin, at least as well suited to our soil and climate as are the exotic varieties to foreign climes, which would fairly rival those foreign varieties in quality and flavor; and I still have confidence that this result will ultimately be brought about through the agency of hybridizing or crossing our native varieties with the finer flavored though tender foreigners \* \* \* \* \*

It must be confessed that these hybrids lose somewhat in hardiness, and generally show some tendency to the maladies common to their foreign parents; still, they vary greatly in these respects, and occasionally approach very nearly to the native varieties in health and hardiness, while they at the same time bear fruit greatly improved, and much resembling the foreign kind."

Mr. J. H. Rickett of Newburgh, New York, has, perhaps, been the most successful propagator or producer of promising hybrid grapes, but all need to be thoroughly tested before they can be recommended for general cultivation.



In a great many of these crossed seedlings, the foreign elements may be detected in the growth and foliage, the habit, and, alas! also in the tendency to mildew, as well as in the mellorated quality of the fruit. In some the firm pulp of the *labrusca* has entirely disappeared, and given place to the meatiness characteristic of many foreign grapes, while also, the foxy flavor has yielded to the milder and more agreeable characters of the *vitis vinifera* as found in its cultivated condition.

In other fruits the case is not by any means so clear that the so-called hybrids have any admixture of the several species they are thought to represent; while among the grains there is perhaps not a single well authenticated hybrid; the "hybrid wheats" are at best but accidental crosses, and they are the result of *selection*.

Indian corn, from its vast importance as a cereal, and especially because of the facility with which it may be manipulated, furnishes the finest field for experiment, and wonderful effects have been produced by the combination of various desirable qualities in the resultant crosses that have been obtained; but as the infinite variety has all been derived from one single species, the *Zea Maize*, there is here no possible *hybridizing*.

When we come to the common garden vegetables, it is doubtful whether we shall find any more satisfactory evidence of valuable results produced by this means. These plants are nearly all traceable to forms in nature that are inferior in value to the esculents we prize in our gardens—many of these are so different from their ancestors that the skill of the botanist is necessary to trace their pedigrees, and their continued improvement must be referred to judicious selection, rather than to any other cause. Many of the cruciferous are so nearly allied that they are very liable to cross-fertilize each other, but this result is to be avoided rather than encouraged, because the effect is a deterioration rather than an improvement. Among the many varieties of the *Brossica napa*, are the Swedish turnip on one hand, and the rough-leaved garden turnip on the other. From these the *Dale's Hybrid* has been derived, but it is a misnomer, being only a cross between two varieties of one species.

The *cucurbitacea*, owing to the character of their inflorescence, with stamens in one flower and pistils in another, are very prone to mix in every garden where different kinds are planted. Here we have several species, and the resultant mixtures may very likely be *hybrids*; but who ever heard of a watermelon being improved by a pumpkin, or a nutmeg by a calebash, or any other improvement by mixing? on the contrary, every gardener is aware of the necessity for exercising great care to keep his stock of seed pure and free from admixture. These plants may easily be hybridized, but with our present experience, the question ever arises—*cui bono*?

### FLOWERS.

In the green-houses and flower-gardens some remarkable results have been obtained by crossing, and there is no doubt we may here find many hybrids. The operator has his subjects more completely under his control, and he has what are admitted to be distinct species, which have often been brought together from distant parts of the world and from different latitudes.

Without multiplying instances, which are here so numerous, your attention is asked to the wonderfully beautiful results obtained by cross-fertilizing those lovely Alpine plants, the Azaleas and Rhododendrons, in which the natives of the Alleghenies and of the Himmalayas have mingled their charms in endless intermixture.

### CONCLUSIONS.

Without desiring to discourage those who may have the means, the patience, the talent, and the necessary perseverance to pursue the delightful occupation of *crossing*

and hybridizing for the purpose of producing new and improved varieties of fruits and vegetables, it is still a duty to impress you with the uncertainty which must attend your efforts. And while those who are endowed with the necessary tact, and who possess the virtues of hope and perseverance may continue to experiment in this very interesting field, it will be safer for the average horticulturist to rely more upon the other means of reaching this grand desideratum. To such the patient watchfulness of the Japanese and the persevering care of the modern European gardeners are recommended, as means more likely to yield the best results in the way of *improvement*.

Like the former, watch most carefully for every departure from the normal characters of our cultivated fruits and vegetables; if such variation can be considered an improvement on what we already possess, mark it well, secure it, and from this small beginning endeavor to increase the stock by careful propagation, always selecting in the successive generations only those which possess the coveted characters in a marked degree, rejecting and extirpating all others near them.

By pursuing such a course, our gardeners have given us the varied characters of our finest vegetables—and to a great extent, our best fruits also, are the result of *selection*. Many American orchard fruits are admitted to have superior qualities, and yet the very large majority of them are believed to be accidental seedlings.

Hoping that your time may not have been occupied altogether unprofitably in the perusal of this paper, allow me to subscribe myself your friend,

WARDER.

It was moved and carried that the thanks of the Society are hereby tendered to Dr. Warder for his valuable paper, and that it be published with the proceedings.

The Society then adjourned until 7 P. M.

#### EVENING SESSION.

Society called to order at 7:30 P. M.

Mr. Wm. Stark of Pike county, Missouri, then read the following paper:

*Mr. President and members of the Missouri Horticultural Society:*

"When and how to prune in Nursery and Orchard," has been assigned to me in your order of business, and, now, in compliance with that order, I submit for your consideration this hastily prepared paper. I shall confine this paper to the treatment of the apple tree, although nearly the same rules and practices will fill the requirements of the standard pear tree.

By way of introduction, I deem it appropriate to say, that different varieties of trees, trees of different habits of growth, require different modes of pruning; also, that trees in a high, dry locality, where they must encounter a great deal of hot, dry winds, and very hot sun, will, as a rule, require much less pruning than the same class of trees would require in colder and damper localities.

The young tree in the nursery row, the first year, will need no pruning whatever, if its growth is confined to one straight upright stem, and if it should throw out several, or even a dozen laterals, I would not advise cutting or pinching them off, if their growth did not have the effect of retarding the growth of the main stem or leader too much. My reason for leaving such laterals to continue growing through the first summer is, that it strengthens the body of the tree, and also causes the formation of more roots. But when one or more limbs throw out on the young tree the first year, at such places and in such manner as to compete with the leader, they should be removed

or pinched back, which may be done at any time during the growing season, but the sooner the operation can be performed the better, as I deem it more or less injurious to remove much of the growth of the young tree at any one time during the first year's growth.

Now, I shall treat of trees one year old in the nursery row. If they are tall enough to make permanent branches, they should be cut off about the time, or before the buds swell in the spring, at the height you desire them to branch; and if transplanted to the orchard they should receive the same treatment; and, also, all the smaller trees which are too low to cut back for permanent branches, should be cut back to a point where the last bud you would leave is well matured, and on wood comparatively well matured, except where the terminal bud is well matured, in which case it is the best bud to lead off for the second year's growth, unless the tree appears too slender, in which case it too should be cut back. No more pruning is now necessary for several weeks. Then in May or June comes the critical time. At this stage of growth thousands and millions of trees have been almost ruined by *mercilessly* stripping off all the young laterals and leaves, except on the new growth of the main stem. If the nurseryman desires the tree to grow up higher for branching next year, and stripping off all the leaves and laterals, except three or four on top, in case he considers they have now established permanent branches for the future orchard tree. I cannot condemn too strongly this injurious practice, for it greatly retards the growth of the tree, and renders what growth is left quite too slender, while the removal of so much of the growth of both wood and leaves at once, during the most rapid season of growth, cramps materially the expansion of the roots, and often very seriously injures the vitality of the whole tree. Some have followed this *most injurious* practice to save labor; others, to make their trees "light and smooth for the shipping trade;" and still others from ignorance of the plainest laws controlling the growth of trees and plants. If the tree is branched properly for the orchard, it often requires no pruning the second year, but as a rule too many branches start out, in which case the surplus ones should be removed generally in the month of June. In this operation the greatest care should be taken to leave such branches as will not grow together, or clash in the future growth of the tree. It is thought, by many, that a leader should always be trained, allowing the top to be formed by the laterals, which should be left in such position to each other that they can never touch in their ordinary future growth; but while I, in the main, endorse this plan in the most of low and compact grounds, yet I do not deem it an absolute necessity by any means, even for this class of trees; and for another class, the upright grounds, I consider this plan objectionable, for in pursuing it you would have to practice continuous cutting back, or allow your tree to grow too high. As samples of this class, I would name Sweet June, Benoni, Northern Spy, etc. These generally incline to grow too close in the head, and as a rule, I believe this class of growers will make better trees if four, five or six branches are left properly situated on the main stem and trained without a leader. During the second year's growth in the nursery, it may become necessary to pinch back the ends of such branches as are making too great a growth to the injury of other necessary branches, and especially does this become necessary where the side limbs grow too rapidly for the leader or center stem. Any small side limbs that may strike out along the body of the tree, as well as all the buds and leaves, should *remain undisturbed*, for these add much to the strength and vigor of the tree in the second year's growth, and to its value in the future.

The smaller nursery trees that are too low to start permanent branches for the orchard during the second season, should be cut or pinched but little, only enough to

encourage the growth of the straightest and best leader possible. Any strong shoots or water-sprouts that may strike out near the ground, on any sort of tree, the second year, or at any time afterwards, should be removed as soon as discovered, for they would often grow later and prevent the tree from ripening up perfectly, if allowed to remain till fall. In some sorts, especially of warm, wet places, it is a good plan about the time the weather gets cool enough to insure that a second growth will not take place, to pinch off the ends of the tenderest and latest growing limbs, thereby forcing an earlier and more complete ripening up of the wood. This is also sometimes done to good advantage on the tree of one season's growth, and even on trees of several years' growth, where their condition seems to require it. This now brings our trees to the size usually preferred for orchard planting, but all those that are not removed from the nursery at the age of two years should be pruned just before the buds start in spring to a single stem, sometimes designated by nurserymen as "whip stock" pruning. Now the side limbs can strike out from older and better matured wood and buds than are to be found usually on trees of one year's growth, and often make trees of the very best quality for orchard planting. During the third year trees in the nursery require almost the same treatment described for the second year. I consider it no drawback to the tree making the third year's growth in the nursery to allow more limbs to remain than are necessary on the orchard tree, as the seeming surplus only adds to the general vigor of the tree. The one, two, or three year-old tree is now ready for planting in orchard.

I have said nothing of the height at which apple trees ought to be branched, and, indeed, in this paper, I hardly know that I should, because so much depends on the general growth and habit of the tree, and the after pruning or no pruning that the tree is to get.

So much on the mode of culture and the uses the orchardist proposes to make of his land, other than for the growth of trees and apples, that no positive rule should be laid down. But for reasons satisfactory to myself, I am about equally opposed to the views of the two extremists—the one who advocates the fodder-pole style of a tree, and the other who advocates the branching of all trees extremely low; one, at least, of the latter class advocates the branching of all fruit trees just one foot from the ground—no more, no less. The medium between these two extremes, in this as in most other matters, is about right. Say from two and one-half to four and one-half feet, mostly from three to four feet, will, under most circumstances, be found about the proper height for apple trees. Dwarf pear, peach and cherry trees, of course, may properly be allowed to branch lower.

When you are ready to set the tree in the orchard, all the roots, when they are bruised or rough-cut by the spade or tree-digger, should be cut smooth, with cut from the underside, and such as are too long should also be shortened in with a similar cut; but, unfortunately, quite too many trees need not this latter treatment.

Now, when the tree is set in the orchard, the good judgment of the farmer must tell him whether to cut and where. If there are no surplus branches of course all should be left; and, if the branches are short and stocky, and the tree seems not to be top-heavy, or to have too much top for the amount of roots left, *then touch it not*; but, on the other hand, if there seems to be too many limbs, and the tree seems to be top heavy, some of the surplus may be cut out, always being careful to cut out now such as would not have room to remain without crowding the others when they get large; and in every case, where the branches are too long and slender, they should be shortened back, for they almost always branch from the end. Now, and hereafter, in shortening

back, the leading or principal limbs in the upright and close-headed growers, the last bud left where you cut should be on the outside. All inside, and other small limbs should be left undisturbed, for the terminal buds on these are usually the first to start to grow on the transplanted tree. Now the tree is set for life, and often needs no pruning at all the first year. If very strong limbs or water-sprouts start on the body they may be removed at almost any time; but smaller limbs on the sides of the trees may be left to advantage for awhile, as they add to the general vigor of the tree, and the expansion of its roots. After the tree has been in the orchard one season, and before the second year's growth begins, it should be carefully examined, and if the limbs are not too long, and are of a length with reference to each other, to insure a good shaped head when another year's growth shall have been added, and all the terminal buds are well developed, then it should be left *severely alone*; but if these conditions do not exist then there is work for the knife. All imperfect terminal buds should be lopped off, and any long or straggling limbs that would cause the tree to grow in an ugly or undesirable shape should be shortened back to a point that will insure the proper shape. Observing now, as always hereafter, in pruning, that the branches on the shady side of the tree are, as a rule, inclined to grow the most rapidly. Now, also, is the time to study closely the general habits and inclination of the growth of the tree (if you do not already know the variety) and determine as nearly as may be, where the tree will grow if you cut here or don't cut there. If it is a low, wide-grower, like the Early Harvest, the strongest and most upright branches should be encouraged; but if an upright grower, the leading limbs should be shortened back every spring for several years, and also forced to grow wider by lopping off, from time to time, a strong, upright limb where there is a side-limb to fill its place by a more lateral growth. By this mode of pruning, some of the upright growers make the most beautiful trees, and, at the same time, it induces earlier and more prolific bearing.

When the tree has been two, three or four years in the orchard, you should, by close examination, determine if there is any probability of any two of the leading branches coming in contact with each other during the time you can reasonably expect your tree to live and be useful; and if you find such to be the case, apply the knife at once, while the limb is yet small. The best time for this, and other spring-pruning, is during the thirty or forty days next preceding the starting of the buds; and the best time for summer-pruning, in this latitude, is usually the month of June and the forepart of July; but sometimes early-growing sorts, in early seasons, may be safely pruned in the latter part of May.

The rule to be observed is not to prune till the water would cease to run from the cut limb, and to quit when the growth of the tree to be pruned is about two-thirds completed. If these conditions are complied with, the wounds made in pruning will heal over rapidly and perfectly.

While such cutting as I have described may, on very small branches, be done at other seasons of the year, a long experience, and much observation, have taught me that the seasons named, all things considered, are to be preferred. But when you crop off long branches on the upright growers, or the too long side-branches on the wider class of growers, in order to make your tree grow in the desired shape, the cutting *must always* be done between two seasons of growth, *never*, in any case whatever, during the growing season. If your tree has been properly trimmed up to four, five or six years in the orchard, it will, never become necessary afterwards to cut off large limbs, and, in fact, I consider the cutting off of very large limbs so nearly akin to murder, that it would be in the wake of very extreme neglect that I would sanction such an operation at all. All the smaller branches or spurs should be allowed to grow un-

disturbed, or at least as many such as there seems to be room for, because, on most varieties, those produce the first fruit. I advise pruning often, and pruning but little at any one time. Shorten back just enough to make the tree grow in the desired shape, and then, afterwards, cut out sharp forks, cross limbs, and such other small limbs as seem to crowd other and more valuable limbs, so as to prevent the top of your tree from becoming too dense to ripen up a crop of good apples; because, if the top of the tree is very thick, the apples will not set with so much certainty, nor will they be so large, so highly colored or of so good quality as would be the case on trees with more open heads. But you must also avoid the other extreme, and not make your tree too open by too much and too continued cutting away of the branches that ought to be left to bear fruit. Too much cutting induces the growth of a host of so-called water-sprouts, which, in all cases, on comparatively young trees, are entirely worthless, if a sufficient supply of other wood has been allowed to remain. These water-sprouts occupy about the same position on our apple tree that the professional and dishonest politician does on the body politic, and should be struck down wherever and whenever found. There is no time inappropriate for their destruction. But, in fact, the best time to destroy water sprouts is just as the bud swells sufficiently to determine what the growth will be, or, at least, while yet a mere germ, just as it is the proper time to squelch out the evil influences of the dishonest politician at the very earliest moment that his true character is discovered.

Having referred to the fact that the branches of most trees are inclined to grow most on the shady side, I will now caution the pruner to cut and not cut in such manner as will cause the south southwest side of his tree to be as well protected as may be from the sun; and in doing this, it may be necessary to shorten back some of the longest branches on the north northeast side, and it is also important to see that the tree is never allowed to lean from the south or southwest. It is best, from the time the tree is planted, and just as long as the condition can be reasonably controlled, to see that it is inclined a little to the south southwest. All pruning should be, if possible, done at a time and in a manner that will require only the removal of small branches, and never even very many of them at once.

Pruning, as considered in this paper, means the cutting off of such wood as seems clearly superfluous, and, at the same time, cutting at such times and in such manner as will induce the future growth of the tree to be located just where it is wanted to fill the expectations of the orchardist, by producing the largest crops of the best apples. All pruning should, of course, be done in a decent, workman-like manner. No haggling, no splitting, no leaving of long snags to be tolerated, which would require years to heal over; and, on the other hand, the cutting must not be so close as to make an unnecessarily large wound.

While I favor the plan of going over the orchard often, I do not, thereby, mean that all the trees should come in for a share of pruning at each going over, but only that you should cut here and there where your judgment indicates it is clearly needed; and thus you can cut while the limbs are small and requiring but little labor, and making but slight wounds on the tree.

For instance, I have Red Astrachan and Duchess of Oldenburg trees in the same orchard, ten years planted, and I can hardly look at the Astrachans without seeing work for the knife, while for the last six years the Duchess have needed no pruning, and from the habits of growth and their general appearance, they will need but little, if any, should they live till the next Centennial.

All of which is respectfully submitted.

LOUISIANA, Mo., December 19, 1876.

WM. STARK.

The paper was received and ordered published, and the Society adjourned until 9 A. M., next morning.

D. L. HALL, *Secretary pro tem.*

The remaining portions of the proceedings are furnished by R. J. Lewis, Secretary for 1877.

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## THIRD DAY.

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### MORNING SESSION.

The Society was called to order by President Evans.

*Present*—R. J. Lewis, Secretary.

Mr. Wm. E. Sheffield was added to the Committee on the President's address.

The essay of N. B. Bateham, of Painsville, Ohio, was then read by the Secretary.

### PLUM CULTURE AND THE CURCULIO.

*Secretary Missouri State Horticultural Society:*

Plum culture, or the planting of plum trees, has been going on quite actively in Ohio for a few years past; and this, I presume, accounts for my being invited to write on this topic for your annual meeting. What I have to communicate, however, is not the result of my own experience, as I am not personally engaged in plum culture, so can only give what I have gathered from observation, and the experience of others.

The disease called "black knot" in plum trees at the east, and the persistent ravages of the curculio in all parts of the country, have led most people to adopt the belief that plum-growing is not to be thought of as a profitable branch of American horticulture. Such at least was the common sentiment in Ohio, until within five or six years past, when it began to be observed that orchards of the common blue damson, in the region of the Ohio river, within twenty miles or so of Cincinnati, were quite productive and profitable, even without measures being taken to protect the fruit from the curculio.

Some varieties of the native Chickasaw plums of the southwest, including the "Wild Goose" from Tennessee, were also found quite productive, and the first very saleable, with but little liability to injury by the curculio. Hence there was much activity for several years in the planting of these trees in southern Ohio. Then an English fruit-grower, locating in Ross county, commenced the propagation of an improved variety of the damson, known as the *Shropshire*. He adopted the method of

grafting scions of this on yearling peach roots, setting the grafts below the surface of the ground. The union appeared to be perfect, and the trees have proven healthy and productive.

Large orchards of these trees were planted, and came speedily into bearing, giving such promise of profit as greatly to stimulate planting, and create demand for the young trees. The Wild Goose plum is also propagated in the same way, and the trees have thereby become cheap, and much planting has been the result.

From all that I can learn, there are not less than *a hundred thousand trees* of these two classes of plums now set in orchards in southern Ohio, and in this and other parts of the State are about *fifty thousand trees* of the finer or European plums. The planting of these last has taken place mostly within the past three or four years. A single venture of two thousand trees of the Lombard, Yellow Egg, and similar varieties, planted in Huron county, northern Ohio, and producing a bountiful crop which sold at high prices, in 1874, gave quite an impulse to the planting of this class of plums.

It was seen that, with proper contrivances for the purpose, the expense of protecting the fruit from the curculio was very light in comparison with the profits of the crop. In fact, it was argued that the curculio was a blessing to the large growers of plums, as no one could afford to fight off the insects from a few trees, and hence amateurs or small planters would not attempt to grow this fruit, and the markets would be supplied only by commercial-growers.

#### A CHECK TO PLANTING.

For the past two years the plum crops of all kinds have been nearly failures in most parts of the State. Injury to the trees by severe cold in winter, and to the blossoms or young fruit by late frost in spring, has been quite general; though some of the damson orchards, on high table lands, produced fair crops the past season. This general failure, for a year or two, was perhaps opportune, in that it had the effect to check the excessive amount of planting which seemed likely to be done. Those who had no experience in the business overestimated the reliability and profits of the plum crop; and most planters seemed to ignore the fact that while a moderate supply of plums will sell for good prices, it is easy to glut a market; because it is not a kind of fruit that is generally consumed—like peaches or strawberries—but is mainly used for preserves and tarts, or purposes for which a bushel or two is ample supply for a family. And when the market is once supplied any surplus can only be worked off at low prices.

#### THE CHOICE OF SOIL AND LOCATION

for a plum orchard is a matter of the first importance. The best results are secured on elevated plateaus of clayey soil—white oak and beech lands, not too rich nor poor, and neither wet nor too dry. If liable to standing water, good drainage must be provided; and before planting, the soil should be plowed as deeply as possible and thoroughly harrowed. If the land is too rich the trees will make a thrifty and late growth, rendering them liable to injury by the winter, and on sandy or warm soil the blossoms start too early in spring, exposing them to injury by late frosts. The usual distance apart for setting the trees is about a rod, though damsons will bear setting a little closer, if land is not plenty. Early in spring is counted the best time for planting, as trees are apt to heave by frost in clayey soils, if planted in the fall, and are also more liable to injury by severe cold. One year old, from the graft or bud, is a good age of trees for planting, if of thrifty growing kinds, on good stocks, and especially if on peach roots.

I find that it is the common impression among plum growers in Southern Ohio,



that the Damson and Wild Goose varieties are as reliable every way, grown on peach as on plum stocks. By grafting quite down to the roots and transplanting so that the junction shall be entirely below the surface, the danger of borers attacking the roots is avoided; and in a few years roots are formed above the junction, so that eventually the tree is on its own roots. In pruning the trees when young the aim should be to have the tops not less than four or five feet from the ground, in order to facilitate the work of catching curculios. Good cultivation is bestowed on the orchards—planting with corn, potatoes or the like the first two years; taking care to plant nothing within four or five feet of the trees; and afterwards plowing lightly in spring, then working with cultivator or harrow so as to keep the ground from becoming hard or overrun with weeds, especially when there is a prospect of fruit.

#### THE VARIETIES OF PLUMS

most approved for market after the Shropshire, Damson and Wild Goose, are the Lombard, (the surest and most profitable of the European sorts,) then the German Prune, Smith's Orleans, Cooper, Duane's Purple and the like. These dark colored varieties are found more reliable and productive than the Yellow Egg, Imperial Gage, Reine Claude, Golden Drop, etc.; but these light colored sorts bring higher prices in the city markets, and in good seasons pay quite as well as the others. By planting a number of kinds all classes of customers are suited, and the season of marketing is prolonged.

The prices obtained for the fruit are exceedingly variable in different markets, and as affected by the supply of these and other fruits—the range being from \$2 to \$5 per bushel at wholesale.

The trees come into bearing about as early as peach trees, commencing at four or five years from planting. There is danger in allowing the trees to bear as much fruit as they are sometimes inclined to do, as much harm results to the trees from overbearing. Thinning the fruit should be practiced quite rigidly when it has set too abundantly. Some orchards in Ohio have been damaged by neglecting this duty. The Lombard variety seems particularly inclined to overbear.

The growers of Damsons and Wild Goose plums in this State, have not as yet found it necessary to fight the curculio; no more of the fruit being destroyed by insects than is necessary for the proper thinning of the crop. But as the orchards become older, it is probable the curculio will increase, and the jarring remedy will have to be used, as is done by the growers of the finer varieties.

#### HOW TO CATCH THE CURCULIOS?

This is the main question with the majority of persons who wish to grow plums. I have no new method to propose, or one that will be found adapted to the wants of amateur fruit-growers.

To apply the remedy every day, or twice a day, for a month, to half a dozen trees, is too much trouble for the compensation; but where several thousand trees are to be attended to, the case is quite different. A month's wages of a hired man is a small sum to be deducted from the value of the crop. The method everywhere approved is that of jarring the trees, and catching the beetles as they fall, upon a contrivance resembling a large umbrella inverted beneath the tree. This consists of a light frame work, covered with oil cloth, in the form of a hopper, as wide as the tops of the trees. It is mounted on a pair of light wheels, with a handle like a hand cart, and as it is pushed under a tree it opens on one side, by the action of a lever, so as to let the body of the tree pass into the center. Then the tree is suddenly jarred or shaken, by means of an implement resembling a stout crutch, about six feet long, which is used by placing its

head in a crotch of the tree and giving a sudden push and pull. It is carried on top of the catcher, and used by the person that runs the machine, as this is found more economical than for two men to go together. An active man, after a little practice with this apparatus, will operate on 800 trees in an hour, or 8,000 per day, if the trees are not too large, and the ground is in good condition. Old or large trees cannot be so easily shaken, and such it is advisable to jar by means of a blow from a mallet, striking on the stub where a limb has been sawed off for the purpose, or on the head of a large wood screw set into the body of the tree.

The time for commencing the jarring process is as soon as the blossoms begin to fade. If the weather is not cold, a few of the insects will be caught at this time, and the trees should be gone over once a day; then, as soon as the number is found to increase considerably, go over them twice a day, until the number becomes small again, which is commonly after about three weeks of catching—say an average of one week once a day, then two weeks twice a day, and again one week once a day—making in all about forty times jarring. In some seasons, and in some localities the insects are more numerous than in others.

#### ANOTHER FORM OF CATCHER.

And perhaps more convenient, is the invention of the late Dr. Hull, of Illinois, and the same in principle as the foregoing, but instead of working on wheels, it is made so light and portable as to be easily carried from tree to tree by the operator, being supported by straps over the shoulders. Dr. Hull had used the wheel machines for some years before he invented this, and he asserted that no one who had tried both, or seen them used, will fail to give the preference to the new or portable form. A patent was obtained on it by Dr. Hull or his heirs.

A very full account of the history and habits of the curculio, also the methods of trapping the insects, and the apparatus used for the purpose, may be found in Prof. Riley's third report on insects (1871), and in his fifth report (1873) is a description and engraving of Dr. Hull's improved catcher above mentioned.

The essay was received for discussion and ordered printed.

Prof. W. Foster objected to the use of catchers as far as now invented, as not being practicable, but advocated the protection of birds, and the use of hogs and poultry for that purpose.

Prof. Riley said that the common plum curculio is not preyed on to any extent by birds, and that birds and hogs have been tried and proved insufficient. He sustained the essay in the use of the catchers, where required on a large scale, but advised the use of all other methods as well.

Prof. Swallow stated, from an experience of over ten years, that if chickens were confined under the trees, a crop would invariably be secured.

The President then announced committee to examine and correctly name fruit on the tables, as follows: Messrs. Espenlaub, Salisbury, McBride, Kelsey and Miller.

On motion, the Society adjourned until 2 o'clock P. M.

## AFTERNOON SESSION.

Major Z. S. Ragan, of Independence, Missouri, read an essay, as follows:

WHAT IS THE BEST PAYING METHOD OF MANAGING A COMMERCIAL ORCHARD IN WESTERN MISSOURI?

The above subject, as announced in the programme for this meeting, may not cover the ground most desired upon this subject. If I digress a little, I trust that I may claim your indulgence in alluding to some of the leading principles of the profitable management of an orchard. It is hardly presumable that the orchard should be already in a bearing stage before we commence its management; for if, after a series of years, with all the train of labor and expense, the orchard has reached the time for bearing, and profitable kinds have not been planted, all fond anticipations as to profit may be blasted. Even should a judicious selection have been made, often when the trees have been let run at will, with splitting forks and bodies bent out of proper position, with heads not properly balanced, the first full crop may ruin many of the trees, when it is too late to remedy the evil. Hence, it is of vast importance that we begin right and keep right. To use an oft-repeated saying, that the price of good fruit is "eternal vigilance."

If we were treating of orchards at large, it would be important to select the best situation to be had (other things taken into consideration), and, if wet, give directions for proper drainage and preparation of the soil, etc. But as we are down for a commercial orchard, we presume that any one embarking in such a protracted and expensive business will count the cost, and look well to a suitable location and situation, and, at the same time, be sure that his lands have natural drainage, without heavy expense of ditching or fertilization. While these difficulties may be overcome, in a small way, for convenience on a farm, still it will not be expedient on a large scale. The site for an orchard will claim our first consideration. If one fails in this, the error will be fatal.

Dr. Warder, in speaking on this subject, says, "that the orchard is a permanent investment, and so much depends upon the site, that we should make some sacrifice of our convenience rather than commit an error in this particular;" and further adds, "that the orchard should be well exposed to the sun and air."

In times past, sheltered locations were sought after as best for orchards, but that theory is fast giving way, and high localities are more in demand. Altitude is a desideratum, often avoiding both early and late frosts. High, exposed locations, surrounded by low valleys, where the colder air settles, and the warmer, rarified air floating above and coming in contact with the higher points of land, has its modifying influence, and often saves a crop of fruit, both in the bud and in bloom. It is a very important thing to determine the frost-line; especially where we are far removed from large bodies of water. If we cannot arrive at any definite conclusion, we may determine so nearly as to tell whether the location is safe or unsafe.

SELECTION OF TREES.

Notwithstanding a good and favorable location may be secured, and thorough preparation of the ground, yet, if the trees are not properly selected and handled, the labor and expense are in vain, and the whole work and expense have to be gone over in case of a failure, which is too often the case. If one could well do it, it would be well to go to the nursery and select the trees, and superintend the taking up, puddling

and packing, so as to prevent even the finest roots from drying up to the time of transplanting.

#### TRANSPLANTING.

Each tree, before planting, should be carefully examined, and all cut, bruised or mutilated roots smoothly cut off, and the top shortened to correspond with the amount of roots. As to the depth of digging holes and setting, there is great diversity of opinion—from two inches to two feet. My experience has been for setting on level lands, not subject to wash, two to four inches deeper than the trees grew in the nursery. Yet, upon broken or rolling lands, subject to wash, I would recommend deeper setting. The setting should be carefully and well done, observing at the time to lean each tree to the southwest, since our heavy, prevailing winds in summer, when the trees are in full leaf and making their greatest growth, often sway them out of their correct position, exposing their bodies to the scorching summer's sun, also to the rays of the winter's sun at the warmest part of the day, which thaws the bark on the top-side and again freezes at night; and day after day, alternating between freezing and thawing, it raises and ruptures the bark, and furnishes a good harbor for the Flat-headed Borer, and is the final and sure destruction of the tree, which finally blows down by storm or by the weight of a crop of fruit. After every heavy rain and storm in summer, it will be necessary to pass around and press each tree that has been misplaced back to its desired position, till the trees become established in their correct positions.

#### SELECTION OF KINDS

Is a matter of the greatest importance. It is with the greatest diffidence that I approach this part of my subject, knowing, as I do, the great diversity of opinion, and that it will be utterly impossible for me to satisfy even a majority. I will, however, treat of some erroneous extremes that our horticultural people, as well as all other people, are liable to drift into, and then I will mention some of the leading kinds that I have handled, as well as some that promise well in the bounds of my acquaintance. Formerly, persons who planted apples largely for commercial purposes made selections of all the kinds to be obtained at the nurseries in their reach, and when these orchards came into full bearing, it was found that this was not a judicious selection; and this person would give it as his experience that one certain variety was of more value than all the rest of his orchard, and that if he were going to set again, that he would set ninety-nine-hundredths of his next setting of that one sort. Probably the next man would wish to avail himself of this man's lifetime experience, and he would set all his orchards of that one kind and be sure of a fortune; but his location and soil is not just suited to this particular kind of apple, or the fruit is not so good, and does not command the highest price in competition with better fruit in his market, and he too is disappointed.

Thus it is that people often run from one extreme to another—a too common error of our people. Still, after our experience, I fear that there is too great a disposition among commercial orchard men to cut down their lists of kinds to three or four; and probably the quality of these kinds may not come up to the standard of excellence required by the educated taste of our community.

We must take into consideration that as fruit becomes more plentiful, people will become more discriminating, if not even fastidious, and begin to look to men who can furnish them with a good and superior kind of fruit. Then, a second-class or third-class fruit, if sold at all, will have to be at a reduced price, and one, too, that will not likely pay transportation. At such times, only superior fruit will pay.

For a commercial orchard, we want fruit to supply the market throughout the year. For summer, I would mention, Early Harvest, Red Astrachan, Early Pennock and Benoni. Fall—Rambo, Fall Wine, Malden's Blush, Fall Pippin and Mother. Winter—Grimes, Golden Pippin, Northern Spy, Peck's Pleasant, Clayton, Janet, White Pippin, Winesap, Ben Davis, Pryor's Red, Missouri Pippin and McAfee's Nonesuch. To these may be added, Bailey's Sweet, Smith's Cider, Rome Beauty and Fallawater. The White Bellflower does well here in some places, and commands good and ready prices. The Stannard is bearing young and promises to do well with me. There are some new kinds that are now candidates for favor, some of which may, doubtless, become an acquisition to our list, to-wit: Lawson, Huntsman's Favorite, and two new kinds being introduced from the State of Arkansas, by Col. H. M. Vaile, Shannon Pippin and Crawford Pippin. Judging from the specimens sent by mail, they are very fine, and, being a winter apple, that far south, they will certainly keep well in this latitude. We have to look to our climate, or farther south, to originate seedlings for good keepers.

#### PEARS.

This very desirable and superlative luxury seems to have so many draw-backs, and is so subject to blight, that people are becoming more cautious in planting, and only in a limited way. Having planted a pear orchard in Indiana thirty-five years ago, that has so far escaped blight and been profitable, I was encouraged to make a new plantation in this vicinity eight years ago, which was meeting my most sanguine expectations, till the locusts invaded our country in the fall of 1874, and stripped off the coat of leaves, and the following spring again seriously damaged the trees, so as to cause a loss of about eight per cent. out of one thousand trees. Still they have mostly recovered, and made very extraordinary growth the past summer, and have formed a fine lot of bloom-buds for next spring.

The list that I have selected to cultivate mostly, is, in part, Early Madeleine, Bartlett, White Doyenne, Clapp's Favorite, Doyenne Bussock, Seckel, Flemish Beauty, Beurre d'Anjou, Edwards, Sheldon, Buffam, Howell, Winter Nellis and Vicar. Dwarfs, Duchesse d'Angouleme, Swan's Orange, Beurre Superfine, Beurre Bosc, with a tree or so of quite a number of more kinds.

#### CHERRIES.

Early Richmond or May, May Duke, Gov. Wood, Yellow Spanish, English Morello, together with many other kinds. Early May, May Duke and Gov. Wood seem to be the best with me.

#### PEACHES.

Hale's Early, Troth, Early Crawford, Old Mixon Free, Early Newington, Stump-the-World, Late Crawford, Smock's Free, Heath Cling, Snow Cling, Ward's Late, Salway and Evans. To these we have added, of new kinds not yet fruited with us, Amsden, Alexander, Early Beatrice, Early Louise, Early Rivers, Foster, Steadley, Flenere Oling, Chinese Cling and Golden Empire. These kinds will give a succession, ripening so as to afford this delicious fruit for a term of five months, giving to the peach a much greater value as a market fruit, than when they were only in season for a few weeks.

The foregoing list of apples, pears, cherries and peaches may include some kinds that may not prove profitable in all locations, and others of value and merit may have been omitted. Still, having so freely given my views, I will leave others to consider, adopt, amend or reject.

## CULTIVATION.

Orchards should be well cultivated for four to six years, or until they begin to shade the ground around the trees, in some hoed or field crops, such as potatoes, melons, pumpkins, cucumbers or corn. After that it should be seeded down to grass. Clover I consider preferable to any other grass, since it produces a quick and dense shade, and the shedding off a portion of its leaves furnishes more fertilization than any other grass, and does not form a binding sod. By mowing the clover and throwing a portion, or all of it, around the roots of the trees, we furnish a mulch during the hot part of summer, so important to retain the moisture, which keeps up the growth of the trees, and serves as a good feeder and fertilizer. If, in time, the land becomes somewhat exhausted from over-bearing, it will be well to give a top-dressing of compost or litter, or barn-yard manure, scattered between the rows at a distance from the trees, as by this time they extend their roots extensively in search of food.

The only stock that can be profitably let run at large in orchards, will be hogs and poultry. Hogs, besides eating the waste and wormy fruit by tramping, rooting and eating the larvæ of noxious insects (which accumulate very rapidly in large orchards), may be one of the greatest aids man can call to his assistance in destroying these insect enemies. Fowls too, are wonderfully destructive among insects and worms, and should have extensive range in orchards, especially turkeys. We should never suffer to have quails destroyed on our premises, as they destroy large quantities of eggs and small insects.

## PRUNING

is a subject of more importance than is often given to it. True, many persons oppose pruning altogether, their objections doubtless arising from over or injudicious pruning. These extremes we are inclined to guard against, and adopt the rational or medium course.

It is hardly presumable that the trees, as obtained from the nursery, have been pruned up to the desired height for the bodies, or have put forth branches exactly suited to shape their tops. It often happens that the trees start out two equal forks, which if left, form what are termed splitting forks, and if left till they commence bearing, are very sure to split off, and the tree is lost. Hence the importance of heading one of these back, or cutting it out and leaving the other to make the main leader of the tree. Where too many forks come out close together some of them must be trimmed out while small, and others from time to time, till the head of the tree is formed without crowding. However, good judgment must be exercised, since some trees naturally have the habit of crowding their heads, and if too much opening be done at one time they send forth a multiplicity of suckers to fill up the vacancy; but by taking out a few at a time the object may be accomplished. I would have the trunks of trees from three to five feet. If the branches start out low they are apt to make an upward or vertical growth, and are much more liable to split than if they, by sending out their limbs higher, are more inclined to take a horizontal direction, and not half so liable to split. Twenty to twenty-five years ago very low bodied trees were all the rage, but experience has taught us the error of that theory, and it would be hard to find one man who raised one orchard after that fashion that wants to try the second. Rampant and straggling growing trees will often need heading back, to keep them from growing too high, or spreading, in order to keep the fruit in reach of the gatherers. By heading back you often thin out the crop of fruit, and the fruit is produced on self-supporting limbs and of improved quality. Heading back is very

essential with young pear orchards, and should be attended to in the fall, observing at the same time to cut out all unripe wood. Pear trees, while being cultivated, should be worked in the early part of the season, which enables them to make their growth in time to mature their wood. If, however, a late growth should be produced from late cultivation or any other cause, so as to leave the young wood in a spongy condition, and if not cut back and a severe winter should follow, blight may be expected the following summer. It may not be out of place here to remind those who embark in the fruit business extensively, and have spent their time and money in rearing a fine commercial orchard to full and successful bearing, that it will not do to fold their hands and think their fortune made. Here begins the important work of saving, marketing and utilizing the product of their labors.

This will require skill, management and experience. All fruit for market should be carefully gathered, assorted, packed and branded, so that when it is sent to market it will fill the representation. In the summer of 1874 I saw Hale's Early peaches, that had been shipped from Fort Scott, selling on this market for forty cents per box, while a party from this vicinity was sending out about the same distance, the same variety of peaches, and getting one dollar and sixty-five cents per box. Thus, while the same variety of fruit, handled indifferently by one party, would not quite cover cost, while that handled by another party yielded a handsome profit. The same rule will hold good with all other fruits.

Another case in point will go to show the want of proper system and management in handling apples. A friend of mine informs me that he visited Colorado last fall, and while in Denver was in a leading house that handled apples extensively—several hundred barrels daily—he made inquiry as to where they looked to for their supply, and was told to the East. He asked if they could not do better in California, and received in answer that California apples were not good. They ordered mostly from Michigan, as they could get apples from there that could be sent out to their customers without repacking. They would prefer Missouri River apples, but seldom got them, except from one man, but what they had to be repacked. How can we expect any better report to come up from this section of country under present management? The course too generally pursued has been for the farmers to gather their apples and pour them into a wagon bed in the orchard, and haul them and empty them into a rail pen or on the barn floor, till they have time to haul them to market. Then they are scooped up into a half bushel and emptied again into the wagon bed, hauled ten to thirty miles to market over rough roads, and sold to some shipper or commission man, then again thrown into the half bushel and poured out into the wareroom floor. Then, to cap the climax, these shippers know nothing of the character, quality or nomenclature of apples, but, with a set of raw hands, tumble them into the barrel and write some name on the head of the barrels, and send them along. Is it any wonder that when they reach their destination they need rehandling? Yea; they would be in good condition for pressing into vinegar, if they would be fit even for that! Shall this state of things continue? I think I will be safe in answering that when the many fine commercial orchards that have been put out in the last decade shall come into full bearing, the programme will be changed.

I will here give the manner that I have practiced in handling apples, and if it is considered better than the one just detailed, would move its adoption, unless some one can furnish a better one. I would have good, new barrels, made and on hand before the time of gathering. Distribute them around through the orchard. Then, with careful hands and suitable ladders and baskets, commence the picking and putting into the barrels, leaving out all inferior or defective apples. These barrels are headed up

and marked as to name and quality, and are hauled off in a spring wagon, either to the fruit house or depot. Apples handled in this way will bear transportation to market without troubling the dealer to overhaul them, and the brand may induce customers to ask for the same kinds in future. Inferior apples had better be thrown away than mixed in with good ones. Yet they can be profitably used for cider and vinegar, or are good feed for hogs, and probably the best antidote for cholera.

In conclusion, I will only refer briefly to the subject of preserving fruits. Canning is too expensive, and also unsafe. There are several new inventions for drying, upon scientific principles, that enable us to preserve the fruit for any length of time, almost as good as in its natural state, and I presume that every well-organized district will be in possession of these discoveries in due time. It is probably of more importance to the commercial fruit-grower to extend the time of keeping the apple till the bulk of badly handled apples are out of the way, than that of all other fruits. Up to the present time the ice-house has been used to great advantage. Prof. Nyce, of Cleveland, Ohio, has a patent on a fruit house, which has been used with some success, yet the ice seems to be the great secret, and the principle upon which he obtained his patent, to-wit, absorbents to take up the dampness, which avails nothing, or may be considered rather injurious than otherwise. The erection of a good fruit house, with capacity to hold most of the best apples of any considerable fruit district, is certainly of such importance as to claim careful consideration. By means of a good apple house we can keep such apples as the Rambo over till next summer, and it will be as crisp and fresh as when gathered in the fall.

Until we avail ourselves of the late and new discoveries, we cannot hope to enjoy the luxury throughout the year of many of our valuable fruits, neither can we realize their worth in dollars and cents.

The essay was referred for publication.

The committee on the treasurer's report then made a report as follows :

The committee appointed to examine the treasurer's report have performed that duty, and find the report correct. We would recommend the Society to order the bills therein presented to be paid, as also the ten dollars loaned by Mr. King to Mr. Muir. Mr. King is certainly responsible to the Society for the same.

We would further recommend that the President take some steps to collect the balance remaining in the hands of ex-treasurer Tice.

R. J. LEWIS,  
W. M. HOPKINS,  
WM. STARK,  
*Committee.*

The report was, on motion, received and accepted.

Prof. W. Foster then rose to a question of privilege, and called the attention of the Society to a report of an essay read by him at a meeting of the Society at St. Louis, 1875, in which he claimed that he was not correctly reported, asserting that the essay, as reported, was not his production, either in form or matter, not even in a condensed form, but a complete perversion of his views, and requested that the records of the Society should show that he disclaimed the language used, and the facts as stated.

On motion, Prof. Foster was requested to address the Society "on the cultivation of the pear."

The motion was carried, and Professor Foster addressed the Society as follows :



## THE PEAR.

It is not the aim to assume the habit of the redoubted champions of romance, and make war on windmills and every other thing that appears to have life; nor to assume superior knowledge of the Hygienic laws which control the success or failure of the noblest of our larger fruits—the pear. If the suggestions, resulting from many years of patient study and labor in the field, the results of which this essay contains, shall only serve to provoke thought, intelligent inquiry, and lead to a more general cultivation of this neglected fruit, my ambition will be fully accomplished.

The expression among orchardists: “we have tried to grow pears, and they are a failure,” has become almost universal; but when asked how they have tried it, their answer shows an utter lack of knowledge of the laws of life, as well as the proper fruiting of the tree. When asked “have you ever examined tables of analyses, showing the earthy matter the tree and fruit contain? and are you certain your soil is rich in these substances?” the answer is usually no! “Are you certain you planted sound trees?” “No; they seemed to be sound, but I am not a competent judge; I planted my trees and treated them as I do my apple trees, which have done well, while my pear trees failed.” Yes! and under the same circumstances they will always fail. As well might you claim, that because your stall-fed milch cow does well on hay and bran, your dog also will thrive on the same kind of food. Hitch him in the stall, feed him plenty of bran, hay and water, and when he dwindles and dies, cry out this is not much of a country for dogs; they become diseased, they blight! Now, the soil that would grow heavy crops of grains, grasses, apples, etc., may be poor, indeed, for the pear. *They* thrive, but the pear tree starves to death. The mortality in dogs would be universal, if treated with that sublime indifference as to their natural food, which most men display towards their pear trees.

No fruit tree in the orchard so readily shows its good keeping as the pear. Give it plenty of iron, (ash from the smith's forge contains it in the form of protoxide— $\text{FeO}$ ), plenty of leached ashes, plenty of air-slacked lime and common salt ( $\text{NaCl}$ ), and the grower will be surprised at the increase of size and smoothness of leaf, as well as a general increase of flavor and size of fruit. The tree and fruit, in a healthy condition, contain other earthy matter, but the above usually supply what most of our soils lack. These substances, too, must be applied in a soluble form, or the spongioles cannot absorb them.

Then we have:

Salt ( $\text{NaCl}$ ), soluble in water.

Lime ( $\text{CaO}$ ), soluble in water.

Black scales of iron ( $\text{FeO}$ ), soluble in potash, which the ashes contain.

Ashes ( $\text{KO}$ ), soluble in water.

These materials may be supplied in small quantities, say a scoop-shovel full of leached ashes to the tree, the same quantity of lime, a pound of common salt, an ordinary shovel full of ash from the smith's forge, once in three or four years, as may be convenient.

It will be seen that most of these materials merely cost the hauling. Copperas, ( $\text{FeO}^3\text{SO}^4\text{H}$ ), applied in small quantity, has in some soils been found beneficial, and never injures the tree on any soil. Unleached ashes are as good as leached for this purpose, and it requires less of them. Neither the wood, bark or fruit contains any common salt, but the fruit contains about nine per cent. of soda, which the common salt supplies in the cheapest way. Salt is an excellent insecticide, and when in contact

with the rootlets, its chlorine is replaced with an atom of oxygen, when  $\text{NaCl} + \text{HO} = \text{NaO} + \text{HCl}$  set free.

Some horticulturists believe that the HCl (hydrochloric acid) is really the poison which kills the aphids that is so destructive to fibrous roots during summer. One dollar's worth of hauling and fifty cents' worth of salt will be sufficient for one hundred bearing trees. No planter need fear to apply salt, leached ashes and air-slacked lime in large quantity, if they are of easy access, for the reason that the tree will only absorb what it needs if all the earthy matter is present which it requires.

A whole barrel of salt has been accidentally emptied under a single pear tree, and allowed to dissolve there. The tree flourished, bearing a heavier crop the next season than ever before. Leached ashes have been applied four inches deep, commencing at the trunk and extending outward eight feet, without injury. Such large quantities are not needed, and are only mentioned to show the distinct appetite of the tree, as well as its power to reject substances not conducive to its health. If it is starving for any one of these compounds, its appetite becomes abnormal, and its roots take up foreign matter, which its organs cannot appreciate, and the tree soon becomes sickly. While in the normal condition, with all earthy compounds required, present in a soluble form, the rootlets select, with unerring precision, just what the tree requires; no less no more.

Man is composed of sixteen organic elements and their numerous compounds. Place him on a diet of salt meat and water for thirty days and his skin will blight, (scurvy). If no vegetable or other food be furnished, he will soon die. Salt meat and water furnished but a small portion of the substances the human body contains, the appetite became impaired, the general functions became weaker and weaker till the chemical force assumed the mastery over the vital. So with the pear tree, lacking certain earthy compounds, a morbid appetite is acquired, certain unhealthy wood producing substances, are taken up, an enormous unhealthy growth is the result; the sap flows so rapidly that there is no time for setting fruit spurs and in a few years the functions of the tree are so enfeebled that it has no further power to appropriate healthful plant food, and it perishes.

No man need infer from the above that a pear tree once unsound by an incomplete supply of plant food, will ever become sound by after good behavior on the part of its owner. It often struggles along for several years, bears well, and exhibits some symptoms of health, but it has unsound wood, which will sooner or later destroy it. The seeds of death were sown by starvation. As long, however, as trees make an annual growth of one foot it will pay to apply to the surface proper plant food, as they often more than ten times pay for themselves in fruit, before they succumb.

Young, healthy trees grafted upon sound stocks properly planted, in well drained soils, and supplied with what the soils lack, do not starve, do not blight in our section; if they are hardy varieties, and are fruited the third year after planting in orchard. Mode of fruiting, culture etc., could not be embraced in this paper for want of space.

The President then appointed L. A. Goodman, Wm. Mustard and Z. Todd, a committee to make final disposition of the fruit on the table, for the benefit of the Society.

Report of committee on memorial of the Governors, made, received and adopted.

The following is the report:

Your committee to whom was referred the memorials prepared by the congress of Governors at Omaha, would report that they very strongly endorse all that has been said on the subject, and much more that could be said by us in this portion of the

country, and insist that it is very imperative and positively necessary for the good of the western country, that something be done in this direction.

The committee suggest that the memorial be signed by the President and Secretary, as embodying the views of this Society.

Z. L. RAGAN,  
W. P. BENNETT,  
L. A. GOODMAN,  
Committee.

The report of the committee on the President's address was read and adopted. It is as follows:

*Mr. President and members of the State Horticultural Society :*

Your committee to whom was referred the annual address of the President, would beg leave to report that they fully agree with the general views therein expressed, and would state that they heartily concur in the suggestion that it will greatly promote the cause of horticulture, and thereby advance the general prosperity of the State, to continue the annual appropriation by the State, of the sum of one thousand dollars, or even a much larger sum to aid the State Horticultural Society. And, whereas, it is evident that it was the intention of the General Assembly by its act entitled "An act to appropriate money for the benefit of the State Board of Agriculture of Missouri, and the State Horticultural Society," approved March 18, 1871, to make such appropriation a permanent and annual one—and whereas, the Society has not received such appropriation for the last four years—therefore, we are of the opinion that the Legislature should be properly memorialized to continue such annual appropriation, as well as to pass such a law as may be necessary (if any shall be considered necessary) to enable the Society to draw the sum of one thousand dollars from the State Treasury for each of the years 1872, 1873, 1874, 1875 and 1876, as was contemplated by the act aforesaid; but which the State officers have heretofore refused to pay over to the Society.

All of which is respectfully submitted.

R. J. LEWIS,  
W. H. MILLER,  
WM. STARK,  
Committee.

The President appointed Prof. Swallow, J. M. Slocum and Wm. E. Scheffield, on final resolutions.

An essay upon the question, Will it pay to beautify our homes? was then read by Wm. E. Sheffield, of Kansas City, as follows:

### WILL IT PAY TO BEAUTIFY OUR HOMES?

*Mr. President, Ladies and Gentlemen :*

The question: Is it profitable to beautify our homes? which has been assigned me for a few minutes discussion, would appear at first blush to be a very limited one; but when we estimate the profit to be derived from any venture, we must calculate the cost, and this again involves a consideration of the method and means to be employed, and the extent to which it shall be carried.

There are many ways in which an investment or venture may be considered as paying, and we shall not expect, in the consideration of this matter, to be confined to the immediate results in dollars and cents. The cost is mostly confined to the pecuniary outlay and the individual labor of the person making the improvements. In most instances, especially in the country, it will consist almost wholly of the labor of

the proprietor ; in cities, and especially in the case of those whose time is at the disposal of others, the pecuniary outlay will be greater. In arriving at the cost, it is best, in the first place, to inquire what should be done in the way of ornamentation? This will of course depend much upon the location, the extent and character of the surroundings, and the ability of the proprietor. It is not to be expected that all such ornamentation will be equally extensive, elaborate or systematic ; but the true standard is, that every one should do what lies in his power to ornament and embellish his own home.

To carry out an extensive and systematic plan of ornamentation would require the knowledge of a civil engineer, as well as the cultivated imagination of the artist, a general knowledge of botany, architecture, mechanics, the laws of heat and ventilation and of vegetable physiology. All the peculiar locations for residences and their surroundings must be thoroughly studied, and a disposition of the various forms of arborescent growth calculated, so as to produce the highest artistic effect. This cannot, of course, be fully attained without the aid of a thoroughly educated landscape gardener, and is not to be expected in general vernal ornamentation. But the universal adoption and continued practice would ultimately lead to a high development of the taste and knowledge necessary to the most complete and effective arrangement. The great advancement made in most of our large cities within the past few years, in designing and projecting extensive parks and boulevards, has done much towards educating a public taste for ornamentation, which we trust will be developed in rural improvements. That it is not foreign to our natures to thus beautify and adorn our homes, is shown by the fact that Adam was placed in the Garden of Eden, to dress and to keep it, that being made his first duty.

The first thing usually to be done in preparing a home, is the building of a house. The precise location upon a tract in a sparsely settled country, should be that which will naturally command the best view ; the same will also, as a general thing, be the most healthy location. We would not put a house upon an abrupt spur, for this would be difficult of approach, but the house should, if possible, be placed where the ground will descend from it in all directions ; enough in the rear for drainage, and if sufficient, for a terrace or two of moderate height in the front, all the better. The out-houses, vegetable gardens, orchards, etc., should all be placed in the rear of the house, and, where the premises are sufficiently extensive, the house should be set not less than two hundred feet from the highway. In villages, or upon small lots, the house should, in all cases, be placed as far from the street as the size of the lot will allow. In cities, there is generally no room for a vegetable garden, and too often but little room for anything except the necessary buildings, but even then the house should be set not less than twelve feet back from the sidewalk, leaving sufficient room for a grass plat, a few rose bushes, as well as a bed to be filled with some of our many beautiful little profusely blooming annuals.

But let us go back to the country, for it is with that we would deal mostly in this essay. As a general thing, in selecting a site for a residence, we would prefer one entirely destitute of trees, unless where there happens to be a few healthy, low-topped, trees, standing at some distance from each other. In such case, they might be of some advantage, but never select a site in the midst of old trees close together, with a view of leaving any of them standing. Having grown close together, their trunks will be long and destitute of branches, and neither desirable for shade or ornament ; and furthermore, our observation has demonstrated that such trees, when left alone, not

being adapted to their new condition, soon die. The best way, therefore, in such case, is to cut the whole away and plant out some fast-growing, thrifty young trees, which will, in a comparatively short time, produce the proper effect, and withal, stand where desired. It is almost impossible to get young trees to grow well when planted among or near old forest trees.

After selecting a site for the house, the next thing to be done is to prepare a suitable plan for the improvement of the grounds. Of course, a thing of the first importance is to select a site for your fruit orchard, when there is room for one, and there is always room, even if the lot does not comprise more than a single acre. But as the planting an orchard and the fruits thereof, does not come within the scope of our essay, we will leave that for others, and come directly to the mode and manner of ornamentation proper of the grounds. Many think that all that is necessary to be done in this respect is to set out, in regular order, and some ten, fifteen or twenty feet apart, any kind of trees which may be most conveniently obtained, and that in time their places will be properly ornamented without further care or attention. There never was a greater mistake made, in fact, leaving the place without trees altogether would be no greater. The first and most important step is to prepare the grounds in front of the house and at the sides, by the best possible method, for a good growth of grass, for there is nothing more pleasant and agreeable to the eye than a smooth, clean, well-cropped lawn. See to this first and the trees afterwards. It is a mistake to suppose that all that is necessary to make a lawn is to scratch over the ground and sow some kind of grass seed upon it, and then go to sleep and wait for a lawn. If you do this, not even upon our richest soil will a lawn be had. The soil must be thoroughly plowed, the deeper the better, and thoroughly manured. The surface should be made smooth and even before sowing the grasses. We say grasses, for no one kind of grass is sure to make a perfect lawn. The best grasses will be found to be the Kentucky blue grass or June grass, as it is sometimes called, (*Poa pratensis*), the red-top (*Agrostis vulgaris*), with a little timothy and white clover. Too much seed cannot well be used for the purpose of making a lawn. We would sow not less than two bushels of blue grass, one bushel of red-top, two quarts of timothy and three or four pounds of white clover seed to the acre. A light top-dressing of coarse manure the first winter, and, in fact, every winter, will be of great benefit. The loose straw should be removed in the spring so as not to interfere with close cropping; this, that is close cropping, and often, is absolutely essential to a good, even, thick-set lawn.

After having taken the steps to secure a good lawn, it will be necessary to select and plant such trees as will produce the best effect. The north and west sides of every tract in the country should be bounded by a row at least, and, if the extent of the premises will warrant it, a double row or belt of trees; and, whether the place is large or small, a boundary of suitable trees should be placed around that portion of the premises appropriated to garden purposes. Of course, upon the south and east sides they should be low-growing, so as not to shut out the sunlight too much. Thick clumps of evergreens should be planted upon all exposed points, thereby affording not only ornament, but protection for both plants and animals.

The selection of proper varieties of trees is essential, as well for the beauty of the effect as adaptability to the soil and climate. A mistake is frequently made in planting trees too near the house. In no case should a tree of any kind be planted so that the limbs will over-hang the house or come in contact with it. Isolated trees, standing near the dwelling, but not near enough to come in contact with it, may not be objectionable, provided they are kept well trimmed up; but in no case should masses of

trees, of any kind, be placed near enough to shut out the light or cut off a free circulation of air. If large trees are allowed to overhang the roofs, the leaves and falling branches will obstruct the gutters, the roof will be continually damp, and it will be found to be impossible to keep the house dry or healthy. It is well enough to plant clumps of flowering shrubs upon the lawn and near the house; but these, to thrive and be of any account, must not be much shaded or crowded together. In short, the trees upon the lawn, except those upon the outside, should be so arranged and cared for as not to interfere with a healthy growth of the grass, otherwise you will not, with the best preparation and most assiduous care, succeed in having a lawn. Air and sunlight are as essential to a luxuriant growth of the grasses as the trees, shrubs or plants. Too much planting of trees would be as great a mistake as not planting at all, only that it is more easily remedied, for a good-sized tree can be more readily removed than supplied. The open, clean, thick-set lawn must, as we have already stated, be considered of the first importance.

Upon the roadside of the lawn, especially if the house fronts to the north or west, I would plant more trees—not in a continuous row, at equal distances, but in clumps and at unequal distances, connecting the clumps in continuous lines by smaller clumps of flowering and ornamental shrubs. In planting clumps, of either trees or shrubs, I would invariably plant but one variety in the same clump; they will then, at a distance, produce the appearance of but one tree, with a more compact and dense head than can be produced from a single trunk or stem. Again, upon the lawn, and exposed to full sunlight, should be arranged spaces for bedding plants. In all cases the roadsides—as well in cities as in the country—should have trees at proper distances, and so arranged as to present uniformity in form and appearance. A street planted with all kinds of trees, varying in form—some broad and wide-spreading, others tall and spike-shaped, as the elm and the Lombardy poplar intermixed, will present a very unsatisfactory appearance, while trees of kindred habits may be placed together with fine effect.

We might mention other ornamentation, as rockeries, hedges, style and arrangement of fences, etc., but the limits of this paper will hardly allow it. Of course, the location, character of soil, etc, will have much to do with the kind of trees to be planted. Ordinarily, I would recommend the white elm as being one of the most rapid growers, and, at the same time, an extremely hardy, long-lived and gracefully appearing tree. The tulip tree is also a very fine tree, of large growth and long-lived. The soft maple is a very rapid grower on almost any soil; easily raised from the seed, and is, for these reasons, quite generally planted. It is not a long-lived tree; the wood is extremely brittle and liable to be broken by the winds, especially on the prairies—would not recommend it. The box elder, a variety of maple, something of the habits of the soft maple but with a much more compact head, thicker foliage and stronger wood, is a much better tree than the soft maple, and is a very good tree where a quick growth is the most desirable quality. The most beautiful of the maples is the Norway, but it is an extremely slow grower. Next, and I think the most desirable of shade trees, would mention the black sugar maple (*acer nigrum*). It is long-lived, perfectly hardy, of beautiful form and foliage, and, with cultivation, a tolerable grower. I would also recommend the planting of the black walnut. This makes a finely shaped tree, is a rapid grower, but should not be planted where it is expected to cultivate the soil, as its roots appear to affect the growth of many small fruits and vegetables. It is with difficulty transplanted and is best obtained by planting the nuts where the tree is desired to stand. The catalpa is a very rapid grower, producing a profusion of beautiful white flowers, spotted with purple, and is quite desirable, although rather irregular

in its form and not very long-lived. The horse chestnut (*Æsculus hippocastinum*), which some mistakingly suppose identical with the buckeye (*Æsculus glabra*), is a beautiful shade tree, a rather slow grower, but of fine form and foliage. It also produces a profusion of fine flowers, puts out its foliage very early and holds it among the very latest. All of the foregoing will answer for either the street or lawn. Some trees, as the mulberry, white walnut or butternut and the chestnut are desirable trees for cultivation where there is sufficient ground, as well for ornament as their fruits and timber. Besides these there are many especially adapted to the lawn, as the European larch, American mountain ash, paw-paw, persimmon, etc. The trees which make the most desirable appearance on the border of the lawn, as well in winter as summer, and also operate as a protection to the garden and as wind-breaks, are the evergreens. Among the best of these are the Norway spruce, a rapid grower and of fine form. The hemlock, which presents a fine, graceful appearance, is desirable, but I fear that it will not do well as far south as Missouri, especially upon the prairie soil. It does best upon a cold, wet clay. The balsam fir is a rapid grower, of fine conical form and beautiful color, but, like the hemlock, does not appear to do well so far south. The American arbor vitæ is very beautiful but does not appear to be quite adapted to our climate. The golden arbor vitæ is a dwarf, of beautiful color, and is said to be hardy, but of this I am not sufficiently advised to recommend it. The red cedar is perfectly hardy, a rapid grower and best adapted of any to ornamental pruning. The most desirable among the pines are the Austrian, Scotch and white, all hardy, rapid growers, long-lived and make large trees.

Among the most desirable and hardy shrubs are the snow balls, tree honeysuckles, weigellias, spireas and altheas. The best climbers are the honeysuckles, trumpet flowers, wisterias, bitter sweet and Virginia creepers. The Baltimore belle is one of the finest climbing roses, but needs winter protection. The queen of the prairie is perfectly hardy, a very profuse bloomer, but the beauty of the rose soon fades, as it changes to a disagreeably leaden hue; still, I consider it indispensable. Roses are my favorite flowers, but the very best are not hardy and need winter protection. Still there are some very good ones which stand the winter well. There are various kinds of lilies which are perfectly hardy, and require but little attention for successful cultivation. A bed of tulips, hyacinths and crocuses, so early and showy, should not be neglected. Gladiolas, in all their varied colors, come later and are the most showy and desirable of all our bulbous flowering plants. Larkspurs, phloxes, pinks, verbenias, petunias, geraniums, pelargeniums, chrysanthemums, and many others are worthy of attention and a place in every garden.

We cannot now consider the habits, character or mode of cultivation of the various trees, shrubs and flowers mentioned, but this information is easily obtained.

Having glanced over the matter thus far, and seen something of what should be done to ornament our homes, the question recurs: Will it pay? That it will not pay in a pecuniary sense—that it will not make a return in dollars and cents the first year or years, is very evident. It is, however, susceptible of demonstration that it will pay peculiarly in the long run. But I propose to call your attention to the way in which it will pay a thousand-fold, not only immediately, but continually, and infinitely better than in mere dollars and cents.

One of the great evils of our times is the almost universal desire on the part of the young of both sexes, who have been born and brought up in the country, to abandon a rural life and occupation, and rush to the towns and cities for employment; and, when we look at the matter candidly, how can we blame them for doing so? What

looks more uninviting, nay, repellant, as an abode for a human being than an isolated farm-house upon the prairie, without a tree or shrub to break the view? And such places, I am sorry to say, are not the exceptions, but the rule. In summer, it may not appear quite as forlorn, because nature will do something toward relieving the desolation; but when winter sets in, and the vegetation and flowers of nature's planting disappear, naught is left but the lone house, with perhaps here and there a heap of straw or a herd of unsheltered cattle crowded up in the fence corners, or under the partial shelter of the old farm wagon or the reaper, which stands out exposed to the elements from the close of harvest until the next year's crop is to be secured. The bleak winds of winter mercilessly sweep the whole scene unbroken; the family huddle about the fire, without a desire to look out upon the desolation and dreariness, much less to venture forth to meet it. What wonder, then, that the boy or girl of any ambition, who has been compelled to remain in such a place year after year, loses all taste for country life and rural occupation, and will, as soon as he or she is at liberty, and sometimes before, fly to the city or town for some more agreeable employment? How much better would it have been in most cases for those children if something had been done to make their homes pleasant and attractive. Had their fathers planted, not only orchards of fruit trees, but in the yards, about the houses and upon the highways, a few forest trees and evergreens, which, in a short time, would have grown to form a pleasant and agreeable shade in summer and a protection from the storms and blasts of winter, there would have been presented a cheerful view upon which they could have endured to look in winter. With what a gratification can the children be assisted and encouraged in cultivating shrubs and plants, and how will they watch their growth and rejoice among the flowers of their own raising. There is no need of argument to prove that the cultivation of a taste for flowers refines and elevates the child, and the flowers, shrubs and trees which he has planted, cared for and watched in their growth, have an attraction for him, and wed him to the spot thus surrounded by the endearments and attractions which make a real home, and if it should become necessary for him to leave it, it will be with reluctance and regret, and his memory will be ever carrying him back to it and the pleasant and happy hours he has spent there, instead of constantly presenting it as a place from which he had fled for relief. A love of home and a cultivated taste for home adornments would have saved many a son and daughter from degradation and infamy, and given the world good, substantial, virtuous and honored citizens, in place of wandering, degraded vagabonds.

Let me urge upon you, therefore, the cultivation and improvement of your families by the ornamentation and adornment of your homes. Encourage the children to plant and cultivate flowers; give them each little beds for the cultivation, as their own, of some of our beautiful annuals. Get up a rivalry among them for excellence, for in no way can you do as much for them at so little cost, and with so great a degree of satisfaction.

Let us not neglect this matter, and when we shall all become, not theoretically only, but practically, interested in the subject, humanity will be elevated, and we shall be found to be co-workers with nature in its only mode of adorning and beautifying this earth of ours.

The essay was followed by an animated discussion, in which all who participated fully concurred in the views of the essayist.

Messrs. Goodman, Lewis and others dissented from suggestions to remove all the forest trees from building sites.

The essay was referred for publication.



The question of the location of the place for the next annual meeting was called up by the President, and, on motion of Mr. Husmann, located at Sedalia.

The time of said meeting was, on motion, made subject to the call of the President of the Society.

Adjourned until 9 o'clock A. M., to-morrow.

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## FOURTH DAY.

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### MORNING SESSION.

Society met pursuant to adjournment.

Called to order by the President.

Essay of Z. Todd, of Harlem, Clay county, Mo., was then read, as follows :

### REPORT ON THE MOST PROFITABLE VARIETIES OF APPLES AND PEACHES FOR THIS LOCALITY.

*Mr. President and Members of the Missouri State Horticultural Society :*

The duty assigned me is, "what are the most profitable varieties of apples and peaches to grow in this locality?" I presume, the reason for assigning me this duty is because it is known that I am one of the oldest inhabitants of this part of the State, having lived in Clay county over fifty years, and growing up with the first orchards here. Having a natural fondness for fruit, my mind has been directed somewhat in that direction. My father had a nursery in my boyhood, and, seeing different varieties tested, I commenced setting an orchard for myself in 1857. I thought then I knew all about apples; so I planted every variety I could get, that had been tested here. I happened on a Rochester man, with a lot of trees direct from New York. I went through his list. When the trees came to bearing, I was disappointed. Those that were winter apples in New York were fall apples here; others failed to bear paying crops; others dropping their fruit before maturity. I saw my mistake, and in the spring of 1867, decided to set one thousand trees more.

Getting hold of a list adopted by the Missouri State Horticultural Society, I thought it almost a perfect guide. So I went to work again; purchased every variety they recommended, I could get. I have now over one hundred varieties in bearing; will not undertake to name them, but select those I think most profitable, from the knowledge and experience I have of the different varieties, for this locality. I will divide them into three classes—summer, fall and winter—and adopt a scale by which you may understand my appreciation of their relative value, giving one hundred as the highest merit of each class.

Summer—Early Harvest, 100; Red June, 70; American Summer Pearmain, 50.

Fall—Jonathan, 100; Maiden's Blush, 75; Rambo, 70.

Winter—Ben Davis, 100; Wine Sap, 70; Rawles' Janet, 50.

This will give us apples the year round, and enough varieties for profit. Now, you will say, I have undergone a radical change; and so I have.

Now, Mr. President, I have come to the conclusion that I know but little about apples, and want but few varieties. I want a good, hardy tree—a good bearer, retaining its fruit to maturity, and the best fruit I can get. The varieties above mentioned come as near *filling the bill* as any I can suggest.

With the peach I have had but little experience, except with the seedling; therefore, from my own experience, I am unable to recommend any particular variety, but will give the names of those furnished me by a friend of some experience.

*List of Peaches, of tested varieties, ripening in the order named:*

Hale's Early.

Troth's Early.

Large Early York.

Crawford's Early—yellow.

Old Mixon Free.

Stump-the-World.

Ward's Late.

Smock Free—yellow.

Heath Cling.

Report of awarding committee was then made and adopted.

The following is the report:

Your committee to award the premiums to exhibitors of fruits, beg leave to report as follows:

For premium No. 1, for the best display of fruit, by any one or collection of individuals, we find two competitors, to-wit:

The Missouri Valley Horticultural Society—Entry No. 1.

The Jasper County Horticultural Society—Entry No. 2.

The former shows fifty varieties of apples, and the latter fifty-three varieties.

We find a large proportion of both lots very good, indeed many of them of great excellence, and after carefully listing the good varieties of both exhibitors, and carefully examining the quality of the same, we award the premium of \$20.00 to the Jasper County Society.

We do not consider it a duty imposed on us on this occasion, but we deem it not inappropriate to give it as our judgment, that both of these societies erred in placing on exhibition several varieties destitute of merit, and some others of so little merit that they should be discarded, not only from fruit shows, but from the nurseries and orchards of the country; but, as a whole, the exhibitions are such as to do credit to these or any other societies.

For premium No. 2, for the best collection of apples, not less than twenty varieties, we find but one entry, that of Mr. Z. Todd, of Clay county, Missouri, who exhibits thirty-one varieties, many of them very fine, and carries off the premium of ten dollars.

For premium No. 3, for the best collection of apples, not less than ten varieties, we find three entries, to-wit :

Z. Todd, of Clay county, Missouri.

J. Madinger, of Buchanan county, Missouri.

H. M. Vail, of Jackson county, Missouri.

These parties exhibited each from twelve to twenty varieties, and the most of them were very fine indeed, the premium being awarded to Mr. Vail.

For the premium for the best single plate of apples, there were exhibited as follows :

R. J. Lewis, Westport, Missouri—Wine Sap.

Wm. Mustard, Kansas City, Missouri—Ben Davis.

Z. Todd, Harlem, Clay county, Missouri—Ben Davis and Jonathan.

W. M. Hopkins, Kansas City, Missouri—Wine Sap.

H. M. Vail, Independence, Missouri—Huntsman Favorite and Missouri Pippin.

All of these apples were superior specimens for their varieties respectively ; but having no authority to construe the word *best* as meaning anything but *best*, we awarded the premium of \$5.00 to Mr. Todd, on his plate of Jonathan ; but we are of the opinion that some of the other competitors, possibly all of them, are more profitable to the apple-grower than the Jonathan.

The other premiums offered were not competed for.

All of which is respectfully submitted.

WM. STARK,  
GEORGE HUSMANN,  
Z. S. RAGAN,  
*Committee.*

# HORTICULTURE

AT THE

## MISSOURI UNIVERSITY.

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ADDRESS OF PROF. SWALLOW BEFORE THE STATE HORTICULTURAL  
SOCIETY AT ITS DECEMBER MEETING.

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The regular order of business was now taken up, viz.: "Horticulture at the State University." Prof. Swallow rose and said:

MR. PRESIDENT: I had expected President Laws would make a statement of the condition and resources of the Agricultural College\* in his speech, but since he will not speak at this session, it will be necessary for me to make a preliminary statement, that my remarks on the subject assigned me may be better understood.

I wish first to show what I have to work with, else you cannot judge wisely of what we have done; for if you send a dozen men into your field, you will expect more work than you would if only half a dozen had been employed.

There is a general impression in this State—a just one in some respects, as all general impressions have some foundation, either true or false—that the Agricultural College has much to work with. It is known that this college has received large quantities of lands and money; and hence the impression that it must have ample means for its teaching, for its experiments and its practical operations. But there has been very little means during the last three years for out-door work. The whole income for the support of the Agricultural College for the year ending September 30, 1876, was \$2,280.25.

But what has become of the liberal endowment? you will ask.

The general government, by the Congressional act of 1862, gave us 330,000 acres of land, all of which had been in the market for several years at 12½ cents per acre; and it was so poor that no one would buy it at that low price. Of this land the Agricultural and Mechanical College had three-fourths, and the School of Mines one-fourth. The

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\* The speech of President Laws was not delivered, as was expected. A change of officers deranged the programme, and provision was not made for it on the evening appointed.

Curators have an agent to manage, sell and lease this land; and the whole income for the year ending September 30, 1876, was \$3,040.83, and the three-fourths belonging to the Agricultural and Mechanical College was \$2,280.25, as already stated—and this is all we have to work with, to pay salaries and all expenses.

What else have we? Boone county gave us a farm for which she paid \$60,000, and \$30,000 in cash. This farm we have, and it is a good one for the purpose designed; and the \$30,000 was put into the scientific building, for the use of the college for its lecture-rooms and laboratories.

But the State gave you something. Yes; the State gave us \$66,000 to finish the scientific building and to purchase apparatus and books. I cannot tell you what was done with all this money, but, so far as I am informed, about one-half of it went into the scientific building; about \$5,000 for chemical laboratory; \$5,000 for philosophical apparatus, and \$166 for agricultural library. The balance was, by the terms of the act itself, appropriated to the liquidation of a university debt. This is about all we have to work with. The Curators also appropriated \$5,000 for apparatus for the agricultural lecture-room, \$3,000 for propagating houses, and \$500 for underdraining; but before this money was spent, the treasury was empty, and the appropriations were suspended, and the money has never been available for these purposes.

(Question by the society.) I would like to ask a question: What is the reason the income from the land is so small, whereas from other States it is much larger in proportion?

Prof. Swallow: The State of New York had about 990,000 acres. The law allowed the State of New York to select that land anywhere in the United States, because she did not have unentered public lands within her own bounds. So with Pennsylvania and other States. The law allowed those States to go anywhere to select their lands. Cornell selected those magnificent pine lands in the northwest. But what in regard to Missouri? The law compelled all the States having public lands to select them within their own limits. We were compelled to take the lands the Government had tried to sell at 12½ cents an acre. What then have we to work with in the Agricultural College? A professor of agriculture and a professor of chemistry, with a chemical laboratory as good as any on the continent. Everything in that department is well filled up. It has been said that no instruction pertaining to agriculture has been given therein, but there are several students who have received this instruction there. I know what has been done in the Agricultural College; and I know instruction has been given in agricultural chemistry to all who have desired it and been qualified for it. Prof. Schwitzer is there for the purpose of giving this instruction. A man's testimony is valuable in proportion to his means of information. Agricultural education has been the study of my life. I taught agricultural chemistry in a laboratory on the banks of the Penobscot, in 1848, under a grant given by the State of Maine; and there are farmers in the Mississippi Valley who were educated in that laboratory, and they are among the best, too. I have steadily and persistently followed this subject up, sir, from the beginning in our own State. I wrote the first memorial that went to Congress from Missouri for this grant of 1862. They thought we were out here in the woods and didn't know anything about agricultural education; yet the State of Missouri was the first to move in this matter. It was my fortune to write the address that led to the organization of the agricultural and mechanical associations and fairs of Missouri; to write two prize essays on agricultural education; to write the bill that provided for the agricultural survey of the State, in 1855; to write the memorial that resulted in the establishment of the agricultural department in the University, in 1859; and to offer the resolution in the Board of Agriculture that led to our having a State entomologist; it was my for-

tune, too, to be the first presiding officer of this horticultural society at its organization in Jefferson City; to be the professor of agriculture in 1859 and again in 1870, when the present Agricultural College was located in the State University. I have examined and collected soils in nearly every county in the State.

I make these statements, Mr. Chairman—though repugnant to my feelings—that my audience may know what opportunities I have had to fit me for my work, and to testify on the subject you have assigned me for my remarks to-day. This duty becomes the more imperative, as some have undertaken to disparage the work Missouri has assigned me to do, and to bring our efforts at agricultural education into disrepute, by ignoring the facts and principles which underlie the whole subject of agricultural progress in our State and nation.

The Department of Agriculture, established in the University in 1859, was abolished by the politicians, but some of them regretted the abolition when Congress made the grant of 1862, for the grant would have naturally gravitated to that department had it still been in existence, and the subsequent expensive contest over location might have been averted. It was good policy to establish the Department of Agriculture in the University in anticipation of the Congressional grant for which we had petitioned, but it was very bad policy for the University to abolish it.

Now let me make another remark in this connection, in speaking of history. I say to those opposed to the location of this department at the University: it is settled there, and now let us make the best of it. Boone county has paid her money for the privilege of the location (\$90,000), so that that question seems to be settled. Now let us make the most and best of it.

When the College was first placed there, in 1870, I was engaged in another part of the country; but I wanted to be in this Agricultural College for which I had labored so earnestly, and I sought the place—the only place, save one, I ever sought. They gave it to me; and what were the facilities promised? “Why, here is a magnificent domain of 330,000 acres of land; we have a fine farm in Boone county—here we will build a commodious scientific building, as convenient as any in America.” It is a plain building, but once inside, you have every accommodation for a scientific school. Now, what else have we? This fine farm given by Boone county; about \$40,000 given by the State. This Society indicated, by its published papers, that it should be fitted up in fine style. Papers read before this Society showed a prospect of having such appliances of agricultural education as the other States have, and several experts to manage the farms and gardens. The Curators, when the people of Missouri asked them “what will you do with this College?” answered, “we will make it like the magnificent and princely institution of Hohenheim, which has a domain of many thousands of acres, and has spent several hundred thousands dollars in fitting it up for its work.” An institution that has its fine horses and all kinds of stock; a farm for sheep, a place for ducks and all sorts of fowls, and men skilled in each department to take charge of the youth who go there to learn agriculture. The Curators said: “We will make it like that famed institution, so far as we have the means.” Such were the prospects placed before us in 1870. But the reality, that which we really have, is pitifully small. In the Agricultural Department proper, that which distinguishes an agricultural from a scientific school, we have a few colored plates of fruit, some bones from the woods, a few common garden tools, and \$375 per annum for the last three years. That is what we have to work with in giving the practical part of our instruction. Instead of several experts in the various departments of horticulture, or one even, our funds will pay only one negro man.

I make this statement not to complain, but that you may know how much to expect.

from us; and let me say, remember that we use this amount for the boys and girls, too, as we have both boys and girls in the classes in horticulture.

Now let me tell you what the other colleges have. Pennsylvania has two farms, finely furnished with not less than \$100,000 worth of stock, and implements and improvements of all kinds; and the Professor of Agriculture is allowed six thousand dollars a year and all he can make on the farm, for the expense of the practical work in educating the pupils. Massachusetts has had, for the last nine years, six thousand dollars a year for the out-door work. I saw, at the Massachusetts State Fair, eight different varieties of blooded stock from their college farm. They have there all kinds of stock, furnished them, and all the improvements of the age; and yet, in addition, the Professor of Agriculture has \$6,000 a year for farm operations. What have we? Nothing but \$375 a year, an old hot-bed and a few implements. Yet you make comparisons; you say "you are not doing what they are in Illinois, what they are doing in Massachusetts and Iowa and in other States. You ought to make more experiments, etc." We ought not to be expected to do as much, yet we have done more in proportion to what we have had to do with, than they have. What did the President of the Iowa College state in the presence of our President the other day? He said: "I have had advertised for two years a practical course in agriculture, and have not a single student;" and yet the Iowa College has a splendid outfit and an annual income of \$50,000. In our College we do not count a student an agricultural student unless he comes to study it practically every day. I am not willing to reckon those who study chemistry and other sciences only, as agricultural students, as other colleges do. Students of law and medicine, as well as of agriculture, are in the class in chemistry; but when we speak of agricultural students, we mean those who take the practical working course. They must study the work and do the work, as well as study the sciences relating to it, or they are not reckoned as agricultural students, and will not get the certificate or diploma of our Agricultural College.

I was brought up on a farm. I love farm work, and the boys love to work with me. I never took a boy out to work with me a half dozen times who did not become interested in the work and desirous of pursuing that part of the course. Sometimes a student will say, "I don't want to plant corn. I already know how to plant corn." I will say, "Very well; go out and see us plant corn, and if you do it as well as we do you can be excused from the subject and attend to something else which you need, until the class takes up a subject in which you do need instruction." But, sir, I have never had one say that he knew all about it after going to work with us a few times. He would say that he could not do his work as well as he thought, and he would wish to go again. The same is true of grafting. When we commenced grafting one young gentleman said: "I was brought up to graft; I want no instruction in grafting." I said, "very well, we will excuse you till we get done with grafting; we do not make this manual labor compulsory, except as a means of instruction, and when you know how to do a thing well you will not be required to do it; you can study something else while the class is at this." Well, sir, he went with me, and then he said he had a great deal to learn about grafting, and continued in the class. We do not insist on manual labor, as such. If you require the students to work every day, even two hours, without regard to their need of it as a means of instruction, you will fail. I tell you that you cannot run an agricultural college on that system. Our boys will not work without a reason for it; but they will go with their professor, as pupils, and work willingly, and if any of the students in the other departments say anything against such labor and working students, they will find it too hot for comfort.

As professor of agriculture, I stand the peer of any man in the University Fac-

ulty, and all regard our agricultural students as the compeers of the other students. There need be no fear that the agricultural boys will not stand as high as any other boys at the University. None will stand higher as long as we manage in the present manner.

I have given these general statements, that you may know what we have to work with, and how we manage the classes.

Now, sir, my subject is horticulture in the University. I will tell you what we are trying to do in this department. We hire a negro man, who is a good workman, handles the hoe well, but he needs somebody to direct him—and that is the only help we have. The rest is done by the teachers and the students. We have three departments of instruction, and I wish to make it very plain to you what these departments are:

First, there is the department of science. There are are a great many sciences at the basis of horticulture.

Second, we have the department of technical instruction, in which we teach the uses of science in horticulture.

Third, we have the department of practical horticulture, in which we teach the modes of applying the sciences taught in the work of the garden and orchard.

The first two are taught in the lecture-room, and the last in the work of the garden and nursery. To illustrate this, we will take the science of botany. We teach botany as a science for all the students of the University. Medical students, agricultural students, classical and scientific students, all go together into the class to study botany as a science. Thus, in the department of science, the horticultural student learns the principles of science. Then the horticultural student is separated from other pupils, and passes into the technical department, where he is taught what use he can make, as a horticulturist, of the scientific principles he has learned. These students then go to the garden, and vineyard, and nursery, where they are trained to use these principles in the work, in planting, hoeing, grafting, budding and pruning.

In the scientific department, they learn that the roots of the apple tree take the food that makes the apple from the soil, and that the leaves digest the food and prepare it to be assimilated in the apple. They also learn that the root of any variety of apple will take up the food necessary to form all varieties of apples, that the roots of the Winesap will take up the food necessary to form not only the Winesap, but also the Ben Davis and other varieties of apples, and that the leaves of any variety will so digest the sap as to form that variety only—as the leaves of the Winesap will so digest the food as to form the Winesap only. This the science of botany teaches.

In the technical department the pupil learns what use he can make of these scientific principles in raising fruits, vegetables and flowers. If he desires an orchard of any particular variety, as Winesap, he must have trees producing the leaves of the Winesap. He cannot get these from the seed, for seeds will not produce the same kind of leaves as the tree from which the seed was obtained. The only way to get these leaves is to grow the trees from the buds of the tree producing the Winesap, by grafting, budding, or some other mode of propagation; because the bud contains the leaves. Grafting is the best mode for apples. We raise seedlings for roots, and the young shoots of the Winesap tree for scions, which are grafted on the roots. Trees thus grown will produce the Winesap, and no other variety. This is the technical instruction.

The student then goes to the nursery, to learn how he can use these principles in the actual work of raising apple trees. We must have roots to obtain the food from the soil, as stated above, so we plant apple seeds, which will produce young apple trees.



But no one can tell what kind of apples these trees will produce. But to raise the Winesap, we must have the leaves of the Winesap to digest the food. Leaf-buds form the leaves, and we must graft the clons from the Winesap tree on to the roots raised from seeds. This operation will give us the apple-root to absorb the food from the soil, leaves of the Winesap to digest the food to produce the Winesap we desire. We then go through the operation of whip-grafting, until all can do the work skillfully. Each labels his own grafts, and when the time comes, each pupil plants and tends his own, and is ranked according to his success. This is the practical part of the education.

Thus we have, first, the sciences taught in the various lecture rooms; second, the uses of the sciences, called technical instruction, which is taught in the lecture room and laboratory; and, third, the practical application in the work of the nursery and garden. In this manner we go through with the science and work of the horticulturist.

We think the students thus taught will make better fruit-growers than those who have no science, and no reason for what they do, except that others do. In our work we raise many fruit trees and vines, and sell them when fit for market. We sell grapevines every year—in some years several thousands.

I will now explain some of the experiments we are making. You may think it strange we have not published these experiments. But we do not wish to publish them until we have arrived at reliable results. Experiments are often worse than useless, because they are published before reliable results are reached. To illustrate: Let us take an experiment we are making on pear blight. Sixteen years ago we planted fifty pear trees in cultivated ground, and thirty of the same varieties in blue grass sod. An average of ten per cent. of those in the garden died of blight each year, while not a sign of blight appeared among the trees in the blue grass. This continued for fifteen years, and I began to think it time to publish the results as reliable. But during the present (the sixteenth) year, the blight made its appearance in the trees in the blue grass. Had we published this experiment as furnishing reliable results, even after fifteen years' trial, it would have induced many to set pear trees in blue grass sod as a perfect remedy for the blight; whereas, the last, the sixteenth year, proved the remedy not a perfect antidote. We intend, therefore, to publish no experiment until we reach reliable results.

Our farm is a good one for our experimental purposes. It has good soils and poor soils, virgin soil and worn out soil. This variety will enable our pupils to learn the management of each kind—how to recuperate the exhausted, enrich the poor, and preserve the productive powers of the rich.

We have worn land, exhausted by about fifty years' cultivation, mostly in corn. Six years ago we commenced our experiments to recuperate this exhausted soil by deep plowing. The subsoil is a clayey marl. This marl we think will increase the fertility of the soil, if gradually mixed with it. To do this, we use the common plow, and follow it with the subsoil plow, which leaves the subsoil in the furrow to be covered by the next furrow of the common plow. Thus, without manure or dressing of any kind, we have raised good crops every season, good and bad, for six years. We shall next try subsoiling and clovering, which will doubtless be better for land so thoroughly exhausted by cultivation as this was.

We are not striving to raise the best possible crops, but the best crops that can be profitably produced in our State. An old farmer once told us how to make our College popular: "Haul all the manure from the town and make your soil rich, very rich, and raise the largest corn in the State, and everyone will praise your farming." But corn at twenty cents will not pay for manure at one-dollar per load. Such farm-

ing as would pay best in Massachusetts would break any farmer in Missouri in ten years. Farming must be varied according to the varying prices of land, crops and labor.

The farmers of Missouri cannot afford to buy manure for their corn crops. We must learn to raise good crops by using our native fertilizers and green manures. Year before last we had no rain to wet the soil half an inch in depth, from June 15th to October 15th, and yet we had good corn on this exhausted clayey land by subsoiling.

A member: I would like to inquire if it is a fact that a very small portion of our State is underlaid by marl?

No, sir; but a very large part of it is underlaid by inexhaustible beds of marl. If this bed of clay, as you call it, through which you cut your streets, were in Massachusetts or England, you could sell it for marl at a dollar a load. This same bed of marl extends the whole length of the State, from the northwest to the southeast, on both banks of our great rivers, and many miles into the interior. The same bed, but of inferior quality, covers all the other portions of the north part of the State, and a considerable portion of South Missouri.

This rich marl along the rivers makes the best soil on the continent. It is productive and durable. You may cultivate it as long as you live, your children and children's children after you, and not exhaust it, if you will only run the subsoil plow down into the underlying marl every few years, and sometimes plow in a crop of clover.

I will tell you how my attention was called to this marl. In 1853 I landed at Weston, and started up that road by the old Pork House. I found where a man, in digging a well, had thrown out marl from a depth of seventy feet, and I found two stalks of corn growing in that marl, fourteen and fifteen feet high, and each had two fine ears of corn, with the ends all filled out. It struck me that that was fine corn to grow on a soil from the bottom of a well. That corn was growing there without cultivation. I then analyzed the material, and found it a good marl. This extensive bed of marl is a source of wealth beyond anything on the continent. Right here, not more than a hundred rods from where I stand, I saw, where the street was cut down, a poke root, which had penetrated to the depth of fifteen feet.

Now, sir, what does this experiment of deep plowing and gradually mixing the under marls with the soil show? Though our under marls in Boone county are not so rich as yours here in the western counties, yet our experiment has run six years, through the severe drought of 1874, through the very wet season of 1876, through good seasons and bad seasons, and we have made good crops of corn every year on land exhausted by fifty years' culture, by simply breaking the underlying marls every second or third year, with the subsoil plow, and without using any manure of any kind. This experiment proves that we can keep up the fertility of our Missouri soil indefinitely by occasionally subsoiling the land, the expense of which will be paid many fold by the increase of the next succeeding crop.

The discovery that we can thus utilize these marls to render our soils perpetually fertile, removes the fear of exhausted lands, and the necessity of buying costly fertilizers, for which Virginia and other old States are paying hundreds of thousands of dollars every year. This mode of recuperating worn soils and keeping up the fertility of the rich ones, is so simple and cheap, every farmer can apply it to some portion of his land every year. Its value cannot be estimated, as its benefits are applicable to at least twenty million acres of our soil, and will continue to all future generations who may cultivate it. This bed of marl under our soil is a perpetual mine of plant food in our agricultural bank, from which the cultivator can perpetually draw, without fear of protest, as this experiment fully shows. It may be proper to emphasize this important

discovery and demonstration, by observing that this one fact is of more practical value to the farmers of Missouri, than would be the cost of making our Agricultural College the equal of Hohenheim. The attention of the State is challenged to it with confidence, and the credit is claimed for our Agricultural College.

#### ANOTHER EXPERIMENT ON HEDGES.

We have six different kinds of hedges growing—four of the Osage orange, one of the arbor vitæ, and one of honey locust. One of the Osage orange is four years old. That I would like to show you. Some of the Curators lately visited it. One of them, Col. Colman, pronounced it the best hedge he had ever seen. I asked him if a rabbit could get through it. He thought not, and that a rat would find some difficulty.

A member: Will you explain the mode of making?

We put out the Osage orange plants about six inches apart, in a straight row, and let them grow one year. At the end of the first year we cut them down close to the ground, and filled all vacant places with new plants. The next year we allowed the shoots to grow until the strongest reached the height of three and one-half feet, when they were clipped to check the growth. As others reached that height, they were clipped, so that by fall we had a good stand about three and a half feet high. Early in the spring, before the bark would slip, we bent them down and wove them in as close as possible to the ground—a heavy man standing on each one till the succeeding shoot bound it in its place. The succeeding season they were cut back as before to about the same height—three and a half feet. In the following spring they were woven down again, making a close web, five or six inches high. The next year, when about fifteen inches high, they were cut back to some eight or ten inches, and in the fall they were cut back to sixteen or eighteen inches. This last summer we pruned it to the proper shape, at the height of three or four feet. It is very even and beautiful, and will turn stock.

It is much dwarfed by the weaving and pruning, which will much lessen the labor of future pruning. It seems to be a perfect success.

Another Osage hedge was planted in two rows, about five inches apart each way. This we cut back in the usual way. It is three years old and looks well.

Another was planted as the last, and woven down as the first. This looks better. It is three years old. On these we report progress only.

We have a honey locust hedge, planted last spring, in two rows, four inches apart, and the plants only two inches apart in the rows. This is opposite the fair grounds, where the fences are much troubled by mules, horses, boys and men. From an experiment made on a small scale, a few years since, it is believed this will make a hedge in three years that will cope successfully with both mules and boys. But we simply report progress. So much in regard to what we are doing with hedges.

We are experimenting with grapes, also. We planted fifty varieties, recommended and furnished by Mr. Husmann. Many of them have died, since we protect none—as we wish to grow only those which are hardy in our locality. The subsoil is a clayey marl, and the late severe winter and drouth killed some and injured others, as was the case in many places.

A committee of the State Board of Agriculture thought they were ruined by pruning. But they were simply mistaken about the causes of the injury.

We also have an experiment in pear culture, as above stated, in reference to the so-called blight. We planted fifty trees of about ten varieties in the garden (cultivated), and thirty of the same varieties in an adjoining patch of blue grass. For fifteen years, about ten per cent. of those in the garden died of blight each year; and not a sign of

blight appeared in the trees in the blue grass. We began to think that pear trees in blue grass would escape the blight; but the last, the sixteenth year, this fell destroyer of pear trees appeared in two of those trees. We report progress in this experiment, as it shows that fifteen years is not long enough to reach perfect results, in some experiments at least. We have not rushed into print. We do not wish to make a show of work and striking results, until we reach those perfectly reliable.

We have also commenced an experiment on our native plums—to so improve them that they will meet our wants—since they are nearly curculio proof, and since few, but fancy and large cultivators, will use the means to protect our foreign varieties. We believe our native plums can be so improved as to equal the foreign varieties. It will take many years to reach the best results. We already have some very fine varieties from the wild stock.

We have also commenced experiments to improve the persimmon. Our trees are three years from the seed.

The wild cherry is another fruit we are trying to improve. The fruit is but little esteemed; but the timber is so valuable that improvement in the fruit is very desirable. Of course we could reach no results in the three years these experiments have been in progress.

We are also cultivating several species of forest trees: Silver maple, sugar maple, walnut, elm, mulberry, red-bud, etc.

The silver maple we find very reliable on our stiff, clayey subsoils. Nature indicates this by the localities where she plants these trees—in alluvial or loose soils, where the roots can reach perpetual moisture. Our experiments also show it. Fifteen years ago, twenty-five of these silver maples were planted in our hickory lands, which have a stiff, clayey subsoil. They grew well, but every drouth and every cold winter killed some of them; and the last of them are now dead. In our climate they will succeed in soils only which are stirred very deep, underdrained, or where their roots are protected by mulch, or some other means, from excessive drouths and frosts. They will do well in towns, where their roots are protected by sidewalks, pavements and houses.

But the sugar maple will do well in all our soils, save those of the black-jack and pine lands. After two or three years, the sugar maple will grow nearly as fast as the silver maple; it is a handsome tree, produces better timber and lives longer. Some sugar trees produce a much more brilliant autumn foliage than others. There are two trees in the Campus noted for their brilliant autumn foliage. We are beginning to propagate these beautiful varieties by grafting and budding. We expect to propagate these very brilliant varieties with as much certainty as we do favorite varieties of apples.

We attempted some experiments in wine-making; but we have not been able to carry them out so perfectly as we wished for want of a suitable cellar. Still, the wine made one year, was the very best I have tasted. In other years it was fair. But, in 1874, the severe drouth prevented the ripening of the grapes; and, some say, the wine made good vinegar. If so, we ought to be well satisfied; for the must contained very little saccharine matter.

In 1870, we attempted to immitate the sweet wine of Hungary. The grapes were allowed to remain on the vines until they began to shrivel. They were then exposed for several days to warm, dry air. The must was very sweet and thick, and the wine sweet, strong and rich in aroma. It was very popular, and we sold it for \$5 per gallon, and could have sold large quantities at that price.

The grapes yielded about half the usual quantity of must, but it could be sold for more than double the price to those who prefer sweet wine. Why not make it then? Some say sweet wines are not so good. So some say that Ben Davis is not so good an apple, yet we grow it because it sells well.

A fraud, practiced on the public some years since, by corn advertised to produce five and six ears on a stalk, led to another experiment. It really produced but two or three ears per stalk. But I concluded the ears could be increased in number by proper culture, and commenced the experiment two years ago. I have succeeded in producing four and five ears. The corn is small, about the size of the Canadian flint. The size, however, can be easily increased, when the number of ears desired is fully established. We believe we shall reach valuable results in this series of experiments. It will require several years.

We have made some experiments with the navy bean, and some with various root crops and garden vegetables. Omitting further details, it may be proper to state we have cultivated about six acres for the purposes of instruction and experiment, and the remainder of the farm is turned over to be cultivated as other farms until we have more means to stock it and fit it up for instructional purposes. I have no care of that, and do not know what it has made.

Now, Mr. President, if you will come and see what we are doing—examine our vineyard, orchard, nursery and garden, and our one negro laborer—I think you will say we are doing about as much as any man, who understands the business, can expect. And all this has been done and made matters of instruction to the students, at an annual expense, \$375 per annum, for the last three years.

If the State wants more work, more experiments, fine stock, good stables, and a model farm, she must furnish the means to procure them. They have ever been deemed hard masters who demanded brick without furnishing the straw to make them; and they would have been deemed harder masters had they demanded brick without furnishing either straw or clay. So the State must be a hard master, very hard, to expect a model farm, gardens, orchards and vineyards, unless she furnishes the labor and fixtures necessary to make them. You cannot expect the Professor of Agriculture to do the work of two men in the lecture room and the manual labor of the horticultural grounds besides. Nor can you expect him to keep the school full of pupils without the means of instruction. You know that we have no apparatus for the technical instruction of the lecture room, and I have told you what we have for the practical work of the farm and garden. Now, will you tell me, as reasonable and honorable men, what kind of an agricultural college you ought to demand at our hands?

Although, we must admit, our Agricultural College is very far below what it ought to be, yet it is not half so mean, nor half so small, as some have tried to represent it. But, we have the foundations and a partial superstructure of a good school—we have the farm, the scientific and literary departments in good condition. But to make a complete Agricultural College, we must have the technical department supplied with the means of instruction, and the farm and garden fitted up for the practical work; for it is the technical instruction and the practical farm work which distinguishes an agricultural from a scientific college.

Come and see us at our work; see our classes in the lecture room, and watch them at their work, and, if you find, on honest examination, we are not doing what we ought to do, with the means furnished to do it with, then fill our places with other and more competent men. You do not care about Swallow, nor about Laws, nor about anybody in this connection. You want an Agricultural College. When you furnish the means of making one, and then find a man there who is not doing well his work,

ask him to leave. No man worthy of the place will stay when he is not wanted. Some of us have, at least, in the language of our President, "the grace of resignation."

But whoever your president or professor may be, you must put the money there before you can have the college worthy of our great State.

The whole income of our Agricultural College for the year ending September 30, 1876, was just \$2,280.25, whereas the income of our best agricultural colleges varies from \$40,000 to \$50,000 per annum.

Everybody knows a large income is necessary for such a school. European governments know it, and hence the liberal, nay, the princely endowments of their agricultural colleges. Our government knew it, and made the grant of 1862. Our State Legislatures knew it, and have increased the national endowment. But our own endowment yields the pitiful income of \$2,280.25. With this we have made the battle, and educated, more or less perfectly, about two hundred students in practical agriculture, and many hundreds in science. We have done many times more practical work, for the money spent, than any other college in the country. And we challenge the comparison.

Allow me to say, in conclusion, as President Laws did not deliver his address, that he is in full sympathy with your desire to make a first-class agricultural college.

He will use all the means in his possession to accomplish so desirable an object, and that he is in full sympathy with the great agricultural movement of the age.

He says there never before was a time when the actual cultivators of the soil rose up and asserted their rights to manage the affairs of their country.

He thinks it the grandest movement of the producing classes. It is as grand as it is unprecedented, to see those who feed and clothe the country rising up and asserting their rights, and their determination to do their full share in governing it. The idea of education, interwoven with the grange movement, is the grandest of all, and the best calculated to secure its success. You may rely upon him to carry out your plans ably and honestly.

I thank you, Mr. President, ladies and gentlemen, for your kind attention to my desultory and prolonged remarks.

PROCEEDINGS SUCCEEDING PROF. SWALLOW'S ADDRESS:

Maj. Ragan: In regard to the soil, I would like to ask if there is much of this heavy clay in the State like that he subsoiled for corn?

Prof. Swallow: There is no soil on this river above Glasgow that is as clayey as ours. Ours is hickory land, and covers a wide area in the central counties. I wish to say, in this connection, that the Agricultural College is working at the classification of the soils in this State. The classification is nearly finished, and, if any one has any inclination to look at this classification, he can readily do so. The soils are named, so that any intelligent farmer can speak confidently of his soil, and the analyses are so arranged he will know what his soil contains and its adaptations.

A member: Haven't we clay here in Missouri?

Prof. Swallow: You have clay and marl. There is clay in the marl. Clay and carbonate of lime are the constituents of marl. These marls are very generally called clays in Missouri. But they are very fertile. This marl is just as good here in Kansas City, where you dig down fifty or a hundred feet, as it is at the surface.

Mr. Foster: When and how was that classification and analyses made?

Prof. Swallow: I had a chemist and an able assistant at work one whole year analyzing the soils of Missouri. We collected soils from every county. We collected at least a thousand specimens of soils, and they are now in the Agricultural College.

I have not now time to give the details of this work, but the classification is based chiefly on the trees. It would take too long to give the details of the many thousand observations made to obtain the facts for the basis. But we have a method of analysis and classification, other than that of the laboratory, and I will tell you what that is based upon. An old country cannot have it, and we should not neglect it now while it is possible for us. It is based on what the soil naturally produces. Judging from what it has produced we can tell what it will produce. In Europe and the old States they cannot have this classification, for their original forests and grasses are gone. When I came here in 1850, we had virgin soil in all parts of the State. We had the native trees and native grasses growing in every county. I have notes made in over ten thousand localities, showing what trees and grasses grow on the various soils. I commenced these notes in 1850, and have continued them ever since—making lists of trees and other plants in many places, in nearly every county in the State. Upon these facts my classification is based.

It has the merit of being easily understood, and of being based on the real productive properties of the soils.

Mr. Foster: I move that Prof. Swallow be requested to furnish a copy of this address to this Society for publication in its proceedings.

The motion carried, and was so announced by the chair.

# MISSOURI AT THE CENTENNIAL.

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BY C. W. MURTFELDT.

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[Communication read by the Secretary.]

Among the many who, by circumstances beyond their control, were compelled to remain at home, while thousands visited the great World's Fair at Philadelphia, in this centennial year of the nation, was your humble servant. As a citizen of this great State, I have felt the deepest interest in the exhibit made by Missouri. Those few persons who did exhibit, and those other few who gave liberally of time and money, deserve great credit. But what shall we say of our State authorities who, if they did not actually prevent a creditable display, did very little to advance or insure the same, by furnishing a liberal fund, to be wisely expended, in order that a fine and full exhibition might be collected and made. If ever there was a penny-wise and pound-foolish policy, it certainly was the one acted upon by our last Legislature and Executive, in thus crippling our State exhibition at Philadelphia.

Many of the citizens of Missouri, who visited the wonderful exhibition of the skill and industries of all nations, were so ashamed and mortified by the insignificant efforts put forth by Missouri, that they would not even sign the visitor's register of their own State as citizens of this great commonwealth.

Agriculture and Horticulture, although lauded by every orator and stump speaker as the foundation of all wealth, by their respective Board and State Society, have ever plead in vain for adequate means to carry on their respective organizations. Time and again has your servant, with others of like intent, urged upon our law makers the necessity for a *liberal annual appropriation*, to be expended in the dissemination of useful knowledge pertaining to the art and science of agriculture and horticulture, and upon every proper occasion, to make a full exhibition of all the natural resources of our State. With all our boasted fertility of soil and favorable semi-tropical climate, I hesitate not to affirm that all the fine fruits upon the tables at our feast, and on the fruit-stands at the corners of the streets, are the products of other States. Ohio, Indiana, Michigan and New York furnish the apples, and California the plums, the pears and the grapes. Having the soil and climate, we lack the knowledge and its application to produce the fruits which we consume.

Contrast the centennial building of Colorado, of Kansas, with that of Missouri; the first, beautiful beyond conception, and decorated with consummate skill, and filled to overflowing with the finest of fruits—visited and admired by thousands of visitors



dally; the latter, an obscure building in an obscure place, scarcely visited at all, and prominent in any one feature of its exhibit, and with not a sign of horticulture within its sombre walls. I grieve and mourn that it should be so, but that does not alter the fact.

How long will it be before the average Legislator of Missouri will be able to comprehend that he, in part, represents a broad, fertile and fruitful agricultural State; that without favoritism or special acts or laws, there are interests connected with agriculture and horticulture so broad and deep that they demand his most profound attention and thought and his most liberal action. The very best talent in our State Legislature, and not, as sometimes is the practice, men of little experience or practical wisdom, should be placed on the Committee on Agriculture. Such a committee would be able to originate measures for the best and general welfare of the farmers and fruit-growers, and to advocate such other measures as may be presented by farmers and horticulturists not members of the General Assembly. In conclusion, allow me to say, that I am decidedly in favor of renewing before our next Legislature the claims of this Society.

The communication was received and ordered published.

The President then announced the standing committees for the ensuing year.\*

Prof. Swallow then offered the following resolution:

*Resolved*, That the Hon. S. P. Twiss be requested by this Society to use all honorable means to obtain an annual appropriation from the State Legislature for the benefit of this Society.

The resolution was amended to include all the members of the Legislature from Jackson county. Resolution, as amended, carried.

The following communication was read by the Secretary:

ST. JOSEPH, MO., December 18, 1876.

WM. M. KING, ESQ., *Secretary State Horticultural Society*:

DEAR SIR: The year now drawing to a close has been a favorable one in most respects for those engaged in horticultural pursuits. The winter of 1875-6 was very mild, and but little injury was done to trees, shrubs or vines.

It is true that much injury was done, early in 1875, by the grasshoppers; so much so, indeed, that many were obliged to rely upon replanting in order to restore their devastated fields. This was especially true of the areas devoted to the cultivation of small fruits. As a necessary consequence, the crop of small fruits was much less than usual.

Thus far, strawberry culture in this vicinity cannot be said to have been a success. As fine berries as could be desired have, however, been grown in private gardens. It is to be hoped that some way will be devised whereby as good strawberries can be grown on an extended scale for this market as are produced by individuals for their own use. While "Wilson's Albany" is the variety generally used, the "Charles Downing" has proved a fine berry, as has also the "Kentucky"; the latter being desirable for the size of the berries and the lateness of its ripening. Both the strawberry and blackberry crops were this year an almost total failure. The raspberry crop however, was better than anticipated, and proved sufficient to supply the home demand. Considerable has been done in the way of planting out small fruits this last spring, and we shall soon be able to supply this market with all that is needed in that direction.

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\*See page 139 of this Report.

The early vegetables did extremely well, and were produced in such abundance as to rather overstock this market, and prices ruled low.

The abundant yield of early potatoes, (mostly Early Rose) caused the price to decline so as to hardly pay the cost of production; but the later plantings yielded poorly, and prices again advanced to remunerative figures.

The early varieties of apples were only in moderate supply, while fall and winter varieties did somewhat better. On the whole, it may be said that our crop of apples was a fair one.

As is well known, the grape does remarkably well in this vicinity, and already large quantities are annually produced. All the leading varieties are cultivated, and the newer ones receive a fair trial at the hands of our vineyardists. A special report by the Vice President of this Society will be made upon grape culture at your annual meeting.

The peach crop was very light this year, while the pear crop was better than for several years past. The blight has been so severe for some time as to not only destroy most of the pear trees, but to discourage their planting out. It may be that in this respect the grasshoppers did us a good turn, as the trees which were denuded of their leaves by them in 1875, did not this season show any signs of blight and bore some fruit. It would be somewhat presuming to draw such a conclusion from the limited premises. Further observation will be needed before we can safely attribute the disappearance of such a formidable enemy of pear culture to such an exceptional cause.

It would hardly be proper to close this report without some reference to the growing interest taken in the cultivation of flowers, and the increased attention paid to home adornments. It is gratifying to every lover of horticultural pursuits to note the great increase in the sales of plants and flowers in this vicinity. What was once considered as a useless expenditure for a transient pleasure, has now come to be regarded as a necessity; not something to be indulged in at rare intervals, but an every day want, to be gratified as other wants, in a reasonable way and to a reasonable extent. With increased means at command, and with educated tastes, it is but fair to expect that the coming year will witness a still greater attention paid to floriculture, as well as to every department of horticulture.

SAM'L N. COX,

*Sec. St. Jo. Hort. Soc. and Northwestern Fruit Grower's Ass'n.*

The communication was referred for publication.

The committee on naming fruits on the table reported :

Your committee, appointed to examine and name the fruits on the tables, beg leave to report that they find from Jasper County Horticultural Society: Fallwater, King, Tolman Sweet, Grime's Golden, En. Golden Russett, Liberty, Milam, Vandevere Pippin, Winteler's Seedling, Pryor's Red, Huntsman's Favorite, Rawle's Jennet, Morris' Sweet, W. W. Pearmain, Fullerton Favorite, Limbertwig, Clopton's Romanite, Winesap, Yellow Bellflower, Smith's Cider, Newtown Pippin, Missouri Pippin, Ingraham, Penn. Red Streak, Swarr, Wright's Jennet, McAfee, Gilpin, Ben. Davis, Willow Twig, Gravinetine, Lady Finger, Pannick, Rome Beauty, Red Winter Sweet, Sweet Romanite, Ortley, Royal Red, Westfield Seek-no-further, and Dade County Seedling.

By Jacob Madinger, St. Joseph: W. W. Pearmain, Pennick Rambo, Fallwater, Gloria Mundi, Winesap, Ben Davis, with several kinds unknown to the committee.

By the Missouri Horticultural Society: Yellow Bellflower, Gilpin, Mickler's Limbertwig, Rawle's Jennett, King, Fulton, Peck's Pleasant, Huntsman's Favorite, Roxbury Russett, Ben Davis, Winesap, Swarr, Winter, May, McAfee, Northern Spy, Jona-

than, Willow Twig, Smith's Cider, W. W. Pearmain, Rome Beauty, Famous, Batchelor's Blush, Romanstem, Ortley, R. I. Greening, Common Pearmain, Talman Sweet, Father Abraham, Sweet Romanite, Newtown Pippin, Pryor's Red, Westfield, Seek-no-further, Vandivere Pippin, Wagoner, Lady Apple and Swarr, with five unknown varieties.

By M. H. Vall, of Independence, Mo.: Winesap, Rome Beauty, Rawle's Jennet, Gilpin, Ortley, Smith's Cider, Ben Davis, W. W. Pearmain, Willow Twig, Missouri Pippin and Huntsman's Favorite.

And also by Z. Todd, of Harlem, Clay county, Missouri, thirty-one varieties correctly named.

G. F. ESPENLAUB,  
W. E. McBRIDE,  
S. W. SALISBURY,  
W. H. MILLER,  
Committee.

The following resolutions were received and adopted :

Your committee appointed to draft resolutions expressive of the feelings of the meeting on the deaths of two of our distinguished members, to-wit.: Judge Henry M. Vories, late of St. Joseph, and O. H. P. Lear, of Hannibal—(Judge Vories, an active member and one of the former Presidents of this Society, and Mr. Lear, an old and faithful worker in the cause of pomology,) present the following resolutions :

WHEREAS, This Society has been informed of the death of Judge H. M. Vories, a member of the Missouri State Horticultural Society, and one of its former Presidents; therefore,

*Resolved*, That in his death the Society has lost an enthusiastic and earnest worker and the State a valuable citizen. His devotion to the cause of horticulture, his inspiring words of counsel, and his zeal will long be remembered by his many friends and associates.

*Resolved*, That his friendly intercourse, his integrity and moral, upright character, all conspire to render him worthy of our respect and esteem.

WHEREAS, Through the reading of the President's Address the death of our friend O. H. P. Lear was announced. Mr. Lear was an old member of the Missouri State Horticultural Society and one of its devoted members, a regular attendant at all its general meetings, and one whom this Society took delight in welcoming and honoring at all our meetings;

*Resolved*, That a copy of these resolutions be recorded on our minutes and also a copy to be sent their respective families.

Z. S. RAGAN,  
PROF. FOSTER,  
H. T. KELSEY,  
Committee.

The Committee on Final Resolutions then reported :

Your Committee on Final Resolutions beg leave to make report as follows :

*Resolved*, That the thanks of the Society be tendered to the members of the Missouri Valley Horticultural Society and to the citizens of Kansas City generally for the kind hospitality extended to this body during its Eighteenth Annual Session.

*Resolved*, That we tender out thanks to the county authorities of Jackson county for the use of the court room during our present session.

*Resolved*, That the railroad companies are entitled to our thanks for giving us reduced rates of fare and transportation.

*Resolved*, That we tender our thanks to the proprietors of the Barnum Hotel for having extended favors to the members of the Society from abroad.

WM. E. SHEFFIELD,

G. C. SWALLOW,

Committee.

The report was received and adopted.

On motion, the meeting adjourned *sine die*.

R. J. LEWIS, Secretary.



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ESSAYS

READ BEFORE THE

STATE HORTICULTURAL SOCIETY,

AT

KANSAS CITY, MISSOURI.

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# ORNAMENTAL TREE-PLANTING.

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BY GEORGE HUSMANN, SEDALIA.

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You have assigned to me the task of reading to you an essay on "ornamental tree-planting," and it is certainly with diffidence that I approach a subject which the pens of a Downing, a Sargeant and a Bryant have discussed so much more ably before me. But one reared in the woods, grown up among our forest trees, can certainly not help admiring them, and may be excused for talking about them. Moreover, it is one of those subjects which should be kept before the people, and should be urged upon them at every opportunity, as so far, unfortunately, the American people, as a whole, have been more noted for *destroying* our beautiful native trees, where they had been planted by the hands of nature, than for *cultivating* or *planting* them. And here, before I enter upon the subject of planting, let me plead earnestly for the *preservation* of our beautiful native trees. Let those who now think they must fell and destroy every tree in their fields, pause and consider but a moment, how long it would take, if they undertook to plant trees around their houses, until the young sappling would attain the magnificent proportion, and yield the cool and grateful shade of the magnificent elm or sturdy walnut they have just lifted their pitiless ax to cut down. Wherever nature has distributed trees around your dwelling, be careful how you destroy them. The time will surely come when you will miss them, and when regret will be in vain.

But there are many sections of this State, and of our common country, where nature has not planted trees; our broad prairies, beautiful as they may be when glowing with their green verdure in spring, or their undulating waves of grass in summer and autumn, are yet monotonous without *trees*, both in summer and winter; and it is especially on our prairie farmers that I would urge the necessity and value of tree-planting, both for ornament and profit. What a contrast between the bleak and naked house, exposed to the full rays of the scorching sun in summer and the icy blast in winter, to the snug cottage in the midst of its tasteful lawn, embowered in trees, among which the mocking bird and thrush sing their glad carols, and encircled by a belt of sturdy evergreens, which keep off the chilly blast of winter. Which of these two is the *home* in the true sense of the word? Ye who complain so bitterly sometimes of your sons and daughters leaving you to seek the pleasures and attractions of city life, have you ever reflected that you must make your home *attractive* to your children to keep them there and make them contented? There is an innate love for the beautiful, a yearning for the attractive and comfortable implanted in even the roughest human breast, and if the fathers and mothers of our country are truly wise they will



foster and cultivate this feeling in their children. The mind of the child is so easily influenced, his young ideas so naturally led in a channel to make or mar the future man or woman. 'Take your boy out with you when you plant, let him render the little help which most children so gladly give, and tell him "this tree shall belong to you, take good care of it, and you will see how quick it will grow, and what a beautiful thing it will be when you have become a man;" give his sister another, or a row of them, and tell the little ones: "Look out that they are taken care of, they will soon shade your play-ground, and you will see how much more pleasant they will make our home," and my word for it, they *will* take care of them.

Here, especially, we count on the assistance of the women of our country, on their ameliorating and civilizing influence. The battle with the stern realities of life may often have blunted the finer susceptibilities of man's nature, but love for the beautiful is innate in every *true woman*, and the mother is all-powerful in cultivating and fostering the taste in her children. She, even more than the father, desires to keep her children at home, and to make it attractive to them; and here is her sphere more truly and more beneficial than at the ballot-box, where she can do more to elevate and purify the nation than in the turmoil of political life, which must be repellant to her better nature. But I trust all here agree with me that trees *should be planted*. The next thing to be considered is, first, how shall we plant? Second, what shall we plant?

#### I. HOW SHALL WE PLANT?

In answering this question, I say: Imitate nature as closely as you can. The true art of the landscape gardener is *assisting nature*. Look at a really fine natural landscape, and you have perfection; but to attain that perfection, nature must have room to develop. Compare, for instance, an elm which has had full space to develop without being crowded, its gigantic branches spreading in graceful curves over fifty feet of unoccupied ground to a tree of the same species, crowded in among other trees, where it runs up, tall and spindling, and often crooked, and you will easily see the difference. Or compare the cedar of our bluffs, where they sprung up among other trees, with their spindling trunks and dead lower branches, to the same tree on some opening, its lower branches of evergreen resting on the ground, tapering into a perfect pyramid, and you will soon see which model you ought to imitate. Look at the outlines of nature's planting. You will find that the graceful rounded curves, the gradual sloping of the undergrowth, are more pleasing to the eye than the straight lines and acute angles of some would-be symmetrical planter. Straight lines are admissible only in a few instances: for instance, when the boundaries are to be defined by them, or where straight avenues cannot be avoided, which are to be shaded by trees. But only gracefully curved lines are *truly beautiful*.

Scatter your trees along the walks and drives, so that each has room enough to fully develop itself, and for shading walks, use mostly round-topped trees, with dense foliage, as they produce the best shade, while at the curves and divisions of walks and drives, groups of evergreens, or shrubs and roses are most appropriate. In the midst of large grassy plats, single specimens of rare trees will be best in place, as there they can show their peculiar beauty of form and foliage to best advantage. Try to create a pleasing diversity, and avoid all strong and abrupt contrasts. Landscape gardening is an art, as much as painting or drawing, and the planter, to be truly successful in producing a pleasing effect, should be familiar with the habits and growth of every tree. He must be able to produce beforehand, in his mind, a picture of what these grounds will be when the trees have attained their full size. He must be able to adapt the trees he plants to the nature of the landscape, whether he wishes to produce the beautiful

lawn, serene in its rounded outlines, or the picturesque on the craggy bluffs of some river, or along a wild glen.

But it would lead me too far, even if I could do justice to the task, to enumerate all the instances to which good taste, together with a study of nature, will readily adapt itself.

I will here name but a few of the most desirable trees adapted to the different locations, and thus come to

## II. WHAT TO PLANT?

### DECIDUOUS TREES.

For shade on walks and drives: Silver Maple, Sugar Maple, Box Elder or Ash-leaved Maple, Elm, American Linden, Osage Orange, Tulip Tree, Catalpa, Sycamore, all the varieties of Ash, Hickory and Black Walnut.

For water-courses, or over wells and fountains: All the varieties of willow, especially the common Weeping Willow, Elm, European Alder. For single specimens on lawns, there are none more beautiful if trimmed in pyramidal shape, branching from the ground, than the Black or Red Birch, Deciduous Cypress and European Larch, while the Chinese Koolruetia, Red Bud or Judas Tree, Dogwood, Mulberry, Silver Bell, White and Purple Fringe, and the Ginko or Maiden Hair tree, are mostly trees of smaller size, well suited for single specimens. The different weeping trees may also be introduced to advantage as single specimens. Among these I will name as especially desirable the Galena Weeping Elm, European Weeping Ash, Kilmarnock and New American Weeping Willow, Weeping Poplar and cut-leaved Weeping Birch.

Among the trees I would not advise to plant, are the Lombardy Poplar, Abile or Silver Poplar, Ailanthus and Black Locust. All of them sucker badly, and are but inferior trees at best.

### EVERGREEN TREES.

The most useful for our climate are the Scotch Pine, White Pine, Austrian Pine, Red Cedar, and for northern, somewhat shaded situations, the Norway Spruce, White Spruce, Hemlock and Balsam Fir.

For smaller evergreens, there is none more valuable than the truly beautiful dwarf, the Mountain Pine, keeping its bright green color all winter, and so hardy that it will grow anywhere. The new dwarf Arbor Vitae, Hovey's Golden, Compacta, Globosa and the Round Top American, are all beautiful, and although they brown slightly in winter, the first shower in spring brings back their lively green color. The American Arbor Vitae, and especially the Siberian, are among the most hardy; but they should be often clipped to make them dense and compact.

The deciduous trees, which I have found best adapted to our dry and arid prairies, are the Catalpa, Deciduous Cypress, Ash, Elm, Silver Maple, Box Elder, American Linden, Osage Orange, Sycamore, Tulip Tree, Koolruetia and Red Bud. Of evergreens: all the Pines and the Red Cedar are the most successful.

# CULTIVATION

OF THE

## STRAWBERRY FOR MARKET.

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BY SAMUEL MILLER, BLUFFTON, MO.

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*Mr. President and Brethren of the Missouri State Horticultural Society :*

Being almost certain that my presence at your next meeting will be impossible, I will try to do my part by correspondence. Brevity may be in order, therefore this shall be made as short as possible.

In the first place, let the ground be cultivated deep and made very rich. Get good strong plants and set them out as early in the spring as the ground will admit. For regular field culture we would recommend planting one foot apart in the row, and the rows three feet apart. Cultivate thoroughly the first season, keeping off all the runners, and in the fall, as soon as the ground freezes, cover the whole with straw, weeds or any other kind of litter. Let the covering be thickest between the rows and be but thinly spread on the plants. The following spring, part the covering at the crown of the plants, and wait until the fruit is ripe—and if these instructions be properly carried out, the grower will be astonished at the result, if he has never seen it tried before. Do no cultivating whatever until the fruit is gathered; then the ground between each alternate row can be dug under, spading in the mulch, and runners allowed to take up this space, while the next be kept clear of weeds and no runners allowed to take root. Thus the third year you have matted beds of three feet width, with alleys the same. When winter comes give these beds a slight covering, and the following season the crop will not be composed of as uniform large berries, but the product will be about as great as can possibly be gathered from the ground. This may be allowed to bear the following year and then plowed down as soon as the fruit is gathered, well manured and a late crop of sweet corn raised, to be in turn again planted the next spring. But there must be a rotation, and one-third of the ground that is to be occu-

pied with strawberries must be planted each year. This we deem about the most practical plan—and it has been successfully carried out by several we know of besides ourself. Bear in mind that deep, rich soil, well cultivated the first season and mulched in the beginning of winter, are the main points of success.

One important thing is to get sound plants with some life in them, and not little, spludding things, that have been grown as thick on the ground as they could stand, and are, perhaps, offered at two dollars per thousand. We would not take such as a gift.

As to varieties: every one contemplating their cultivation should ascertain from some one who has experience how certain varieties do in certain soils, for they differ so much in different localities that it is almost impossible to give proper advice. Our experience will be given, by which those having similar soils can judge.

Downer's Prolific has never failed to give us satisfactory results for ten years, and is still about the most valuable quite early one.

Duchess is claimed to be still earlier, larger, productive, and of excellent quality. We will test it next season.

Nicanor is a most excellent, productive variety, and, if grown in hills on rich soil, of fair size; but in the matted bed it is too small.

Wilson's Albany is still perhaps more extensively planted than all others, because it will stand more neglect and still bear fruit; but no one will vary more than this—for when well grown and fully ripe it is a good berry, and if too much neglected will be small, hard and worthless. It is in our grounds in all its original glory, for we treat it as an old veteran would a favorite war horse (for the good it had done)—but not because we deem it profitable.

Charles Downing, Kentucky, Green Prolific, Seth Boyden, etc., we used to think would do very well, but when compared with some of the new ones last season, they fell so far short that we will only retain them to accommodate others and for old acquaintance sake.

Col. Cheney has thus far not proved satisfactory with me.

Wilder is a splendid berry, but not profitable enough.

Black Defiance is very promising, but like the boy's chicken, is always sitting down—too squatty. Quality, No. 1.

Cumberland Triumph has now been tried sufficient to convince us of its value, and will be our main crop, unless Capt. Jack plants are on hand. As we have come to the conclusion that they are both best, the intention is to plant these two for the main crop, and the others on a smaller scale. The Triumph is large, handsome and productive. Capt. Jack, evidently a seedling of the Albany, is just like it, only "much more so," as some one says. It is larger, handsomer, better, will carry better, and is in point of vigor and productiveness, unsurpassed by any strawberry we ever grew or saw.

Monarch of the West is splendid on sandy soil; has not fruited yet on the prairie.

Star of the West is very large, handsome and excellent, but not quite productive enough.

While upon this subject, I may as well tell the Society that just seventy varieties are in specimen beds on my grounds near Sedalia, where, if we live, we will be happy to show them to any of the members, or others who may be pleased to call on us.

Although the essay only mentions the cultivation of this berry, it may not be amiss to advise that the picking be done when the fruit is dry, the small berries kept separate, gathered and sent out in neat, clean boxes. Last season we sold our Triumph of Cumberland and Capt. Jack, including the Springdale, at 25 cents per quart, whole-

sale, by the crate, while the common varieties were selling at 15 to 20 cents per quart, retail.

In conclusion, I will only state that any man who has land of his own, and does not grow strawberries enough for himself and family, denies himself and them a great luxury, and falls in doing his duty. It is one of the most beautiful of fruits. It is one of the handsomest. It is about as sure a crop, if half taken care of, as any in the world. It will, if plenty are eaten; save doctor's bills, lessen the butcher's bills, and produce cheerfulness in many a family where murmuring and complaint are common. Why, to come in to dinner and hear little ones laughing and dancing around, exclaiming, "we have got strawberries for dinner," is enough glory for us, if we could not have one berry ourself.

Some will no doubt say this is a very simple affair, and they have often read something like it; but the question is, did they ever try it? We have, and can therefore recommend it.

But this may be getting dull to the hearers, and I will close, with much regret that I cannot be with you.

# WHAT FRUITS AND WHICH VARIETIES ARE BEST FOR SOUTHWEST MISSOURI?

BY D. S. HOLMAN, SPRINGFIELD, MISSOURI.

If for the family, fruits are to be grown to accommodate a commendable fondness for all of the fruits and articles manufactured from them, a *long list*, suited to this locality, might be given ; but, if for *profit*—"to make money"—the list must be *short*. Inadequacy of *home* market and expensive transportation in this locality, prevent much for the present which grow beautifully and must pay handsomely when facilities increase. This is mainly so of small fruits.

For profit, we must say the *apple* is "best for South west Missouri," and the larger profit is in a *few* of the best winter varieties, of good appearance and good qualities, particularly good keepers, that can wait for better price than is offered at picking time, if necessary, and bear shipping a long distance, either in autumn or spring, to find a good market. Such are the

Ben Davis,	Rome Beauty,
Winesap,	Smith's Cider,
Rawles' Janet,	Huntsman's Favorite.
Ingram.	

There is profit in the following late summer and autumn varieties, for drying :

Maiden's Blush,	Summer Queen,
Lowell,	Porter.

*Pears*—Have not been fully tested, or made profitable in this part of the State yet, but we will here name such as promise to be the "best to plant for profit:"

Clapp's Favorite,	Duchess D'Angouleme,
Bartlett,	Flemish Beauty,
Lawrence.	

*Peaches*—Sell best with us at the first and last of the season ; the profit is in a few extra early and very late good varieties with most showy intermediates :

Amsden,  
Yellow Allberge,  
Old Mixon Cling,

Early Crawford,  
Stump-the-World,  
Heath's Cling.

*Cherries*—Early Richmond is best.

*Plums*—Chickasaw and Wild Goose.

*Strawberries*—Wilson's Albany.

*Blackberries*—Kittatinny.

*Raspberries*—Mammoth Cluster, Miami and Doolittle.

As intimated above, the small fruits, and some others, cannot be extensively grown *profitably* in Southwest Missouri, or anywhere this far from large cities, unless by some expeditious process they should be canned or dried. We should say the latter, and perhaps, by the Alden process—thus so reducing bulk and weight as to overcome, measurably, the expense of transportation, and in this safe and keeping condition can be sent to market when and where most wanted.

SPRINGFIELD, Mo., December 18, 1876.

# HOME ADORNMENT, INDOORS AND OUT.

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BY OPHELIA M. HUGGINS, OF WOODBURN, ILL.

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One of the most important of home duties, yet one which is often sadly neglected, is home adornment. Every man, woman and child is influenced to a greater or less degree by the influences with which they are surrounded. Happy that one for whom the atmosphere of home is one of purity, if the home to which they hasten be one adorned by taste and a loving remembrance of the likes and dislikes of each member of the home circle. Our home is what we make it—not merely a place in which to eat, drink and sleep; a place in which we stop no longer than can possibly be avoided—but the spot to which we will always return with joy, and around which our tenderest memories should ever cling. That home in which there is no room for beauty, no time for the display of taste in the adorning of house or yard, is no true home. Beautifying our homes does not necessarily call for a lavish outlay of money, but for the judicious exercise of whatever amount of taste we may have.

First of all indoors. Let each room be arranged, not alone with an eye to either comfort or beauty, but to lead to both combined. Let the furniture be such that it can be used daily, if need be. Do not have a room in the house too nice for use, into which the sunlight may not find its way save when visitors are announced. Believe me your visitors will enjoy your society a hundred-fold more in a room which bears evidence of daily use. Did you never make a call, and, leaving, resolve never to enter that house again, though you knew full well there was no lack of cordiality on the part of host or hostess? Every room in that house was stiff and formal. No books on the table, no pictures on the wall, no flowers at the window or in the yard, garden there is none, no adornments, indoors or out. Every member of that household is looking only to the disposal of the labors of each day. There is no thought beyond the present moment. No time for books, pictures or flowers; no time for comfort or the enjoyment of life.

We may, if we will, have our home a joy, not only to ourselves, but to others. Neither is there need to plead poverty. As often the commonest facts of every-day life are told in lines of sweetest poetry, so we may make use of the coarsest materials for the beautifying and adornment of our homes. No matter though the room be small or dark, or illy arranged, a touch here or there, curtains gracefully looped, pictures tastefully grouped, a flower daintly poised in this corner or that, and the poorest room may be made a fit scene for an artist's pencil. Should the room lack light, hang your brightest, highest colored picture in the darkest corner, and lo! you will almost



think there is a window there it so brightens it up. Do you lack pictures? Nonsense. Go to the nearest picture dealer, and when he shows you the largest, most costly one in the room, don't be afraid to say you can't afford it, but take the price of the one and purchase a dozen smaller ones. Bright, cheery pictures let them be, of flower, bird or fruit, something which will catch and hold every ray of light. But don't look there for frames. Go home, and with the exercise of a little joint taste and ingenuity, make them for yourself. You will prize them far more if they are the work of your own hands. Let the frame-work be of the coarsest—the coarser the better, so it is firm; then glue, tack or sew on anything you may fancy for frames. Take cones, large or small, peach or plum pits, shells, seeds or burs of any description, fasten on in some pretty device, color and varnish and place around your pictures; group them together on the wall and note the effect.

A beautiful substitute may be found for pictures by tastefully arranging a few autumn leaves or ferns under glass. Or take a sheet of white paper, trace on it whatever design you may like, and fill in with green moss taken from old trees, place under glass and in a rustic frame, and you have a most beautiful picture of your own devising.

If you lack flowers wherewith to deck your shelf or window, go to the nearest woods, and with your own hands take up violets, ferns or other wild plants, and plant them in whatever you may have on hand. An old raisin box, covered with rustic work, or an old milk crock—cracked for drainage—if tastefully painted, is very neat. A suspension basket is easily made of wire, and filled with moss and trailing vines, is indeed “a thing of beauty.” Or, take a small pan, cover it with a large cone, string smaller ones to suspend it by, and with some bright, pretty flower within it, it will prove a wonder to all beholders. A small basket of ivy, suspended at the window, is an ornament unequalled by the most costly knick-knack. A few flowers judiciously arranged throughout the room, will give an air of cheer that is very gratifying. In short, there are a hundred ways in which a tasty person may decorate and adorn their rooms, even though their means be limited.

The exercise of a little taste will often go further towards making a house home-like than the most extravagant outlay of money. And speaking of money, use that which is saved from the picture frames and flower pots, and try a few good books. They are something one can hardly manufacture for themselves, and certainly cannot do without. And never mind about the handsome binding. A half dozen books in plain covers will prove more satisfactory than one in “green or gold.”

But let not all our time be spent indoors; there are duties without as well as within. Though nature has given us an elaborate background of green grass and noble trees, she leaves much to our own judgment as to the best plan for bringing out the foreground of our picture. While she furnishes ample material, ours must be the labor, and a delightful task it will prove, if our hearts are thoroughly interested in the work. The cultivation of flowers is an occupation which exerts an influence at once happy and refining, inculcating a taste for all that is good and pure. Did the Creator make flowers for naught? Were they intended to bud, bloom and wither unseen by those in and around whose paths they are scattered? No, but for our enjoyment they are here, and in every heart there is instilled an innate love for them—a desire to care for and cultivate. There is nothing which will make our home more attractive than a well laid out and well cared for garden; nothing more in place than flowers, ornamental plants, trees and shrubbery around the house. But in planning and arranging the door-yard, let the two extremes be avoided, neither crowding nor by too carefully observing all the rules of order—allowing the yard to look stiff and unnatural. To grow the beautiful

hedges, the rows of shade trees, forming a wind-break to house and orchard, or the stately pines, which now adorn so many of our western homes, is a work of time—one which can scarcely be accomplished but by years of labor. But the ways of adornment are many. While we wait for the trees of slow growth to attain that size when they are ornaments enough in themselves, let us have miniature forests in their shade. Let the lawn be dotted with evergreens and ornamental shrubs. Plant flowers where their fragrance will enter the house. Group them as you will, so they are not stiff and formal. A small mound, with a vase or jar in which may be planted some hardy vine will be an addition to the door-yard. A rockery is another ornament, easily obtained, lasting and a most beautiful sight. Plant there the flowers which require the least care and will sow themselves year after year. The petunia, portulacca and yellow anyrtle, will be found to do remarkably well in such a place. A good idea is to plant also with bulbs, such as tulips, hyacinths, narcissus and crocus. They are up and blooming at the first breath of spring, and ready to vacate by the time the other flowers are up. Out-doors, as well as in, there is ample scope for the exercise of taste; and few, if any, will ever regret the time given to adorning their homes.

But do you say, "we cannot spare time for such work." My poor, tired friend, what were we made for? Why were we placed in this beautiful world at all? If our Creator had intended us only for labor, would he have sent us here where all around us is beauty? Would not this world have been one great barren work-room, and we but tools whereby the work should be accomplished? I do not believe that upon this earth there is one human being who has not at some time a yearning for the good, true and beautiful. True, the time comes in the life of some, when that sense may be obliterated—nevertheless it has been. Was it there for naught? Might not care and nurture of that sense have germinated a pure and lovely soul, such as its Maker intended it should become? The loveliest flower, if left alone and uncared for will at length succumb to the coarse flowers and rank weeds by its side, so must the finest nature at last become coarse if only associated with that which is coarse. So let us cultivate daily and hourly this love for the beautiful. Not only in ourselves, but in those around us. Let our surroundings be such that a love of all that is good, pure and beautiful will be a part of our nature, and will grow and expand with our own growth.



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# INDEX.

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NINTH ANNUAL REPORT

ON THE

NOXIOUS, BENEFICIAL,

AND OTHER

INSECTS

OF THE

STATE OF MISSOURI,

MADE TO THE STATE BOARD OF AGRICULTURE, PURSUANT TO AN APPROPRIATION  
FOR THIS PURPOSE FROM THE LEGISLATURE OF THE STATE.

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BY CHARLES V. RILEY,  
State Entomologist.

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JEFFERSON CITY :  
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1877.

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# PREFACE.

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*To the President and Members of the Missouri State Board of Agriculture:*

GENTLEMEN:—The following pages constitute my Ninth Annual Report on the Noxious, Beneficial and other Insects of the State of Missouri, laid before you in synopsis at your last annual meeting.

During no year since I have been studying the habits of the insects of our State, have the farmers enjoyed such general immunity from insect ravages as during the past year, if we except the work of the Rocky Mountain Locust toward the end of the growing season. This immunity was largely due to the wet character of the summers of 1875 and 1876; for it is a fact that I have frequently laid stress on, that the larger number of the cultivator's worst insect enemies thrive and multiply most during dry seasons. While there was general immunity from insect ravages throughout the State, it was all the greater and more noticeable in the western counties which, in 1875, had been so sorely afflicted. The native locusts were scarce, the Chinch Bug was scarcely heard of, and the general freedom from noxious species, there, which I had anticipated in my Eighth Report, was the subject of remark with all close observers.

It is unnecessary to call particular attention to the subject matter of this Ninth Report, further than to state that a preponderance of space is devoted to that Western scourge, the Rocky Mountain Locust, which again invaded, from the Northwest, most of the fertile country between the Mississippi and the Rocky Mountains, and laid eggs over a larger area than ever before. Reaching our western counties late in the season, the insects did comparatively little damage in Missouri, except to Fall wheat, which was mostly eaten down and killed. They left their eggs, however, and much injury may be anticipated this Spring. A repetition of the ravages of 1875 is probable, but not in the counties most ravaged that year, which will not materially suffer.

The particular counties in which injury may be anticipated are detailed on p. 67. In order that the Report may be distributed among the farmers in those counties in time to be of service to them, I have hastened its publication by omitting articles on the Hessian Fly, the Grape Phylloxera, and some other insects which I had more particularly studied the past year.

In proportion as this Report, and the preceding one for 1875, are circulated in the western counties; in that proportion will the labor bestowed upon them and the experience contained in them prove profitable to the State. I sincerely hope, therefore, that the illiberal spirit manifest in the Twenty-ninth General Assembly, in the attempt to abolish the State Board of Agriculture, and the refusal to make any appropriation therefor, will give place to more generous and enlightened action that will increase rather than diminish the means for usefulness of the only State organization created especially for promoting the farming interests of the State.

In this, as in the previous volumes, when the insects treated of are new, or the existing descriptions of them are imperfect, or in a foreign language, or in works out of print or difficult of access, I have added a full description, which is, however, always printed in smaller type, so that it can be skipped by the non-interested reader. I have endeavored to give a popular name to each insect of economic importance, and this is invariably accompanied, wherever accuracy demands it, by the scientific name, and the latter is generally printed in *italics* and mostly in parenthesis, so that it may be skipped by the practical man without interfering with the text. The Order and Family to which each insect belongs, are generally given under each heading. The dimensions are expressed in inches and the fractional parts of an inch. Where so small, however, as to render such measurement inaccurate, I have adopted the millimeter—one millimeter (1 mm.) not quite equaling twenty-five hundredths of an inch (0.25 inch.) The sign ♂, wherever used, is an abbreviation of the word "male," the sign ♀ for "female," and the sign ♀ for neuter.

Some of the figures are enlarged, but the natural size of each of such is also given or indicated by a hair-line, except in the representation of enlarged structural details, where they are connected with the life-sized insect to which they belong.

The name of the author of the species, and not of the genus, is given as authority; and in order to indicate whether or not the insect was originally described under the generic name which it bears, I have adopted the following plan: When the specific name is coupled with the generic name under which it was first published, the describer's name is attached without a comma—thus indicating the authorship of the dual name: e. g. *Phycita nebulo* Walsh. But when a different generic name is employed than that under which the insect was first described, the authorship is enclosed in parenthesis thus—*Acrobasis nebulo* (Walsh;) except where the whole name is already in parenthesis, when a comma will be used for the same purpose: e. g. (*Acrobasis nebulo*, Walsh.)

All the illustrations, unless otherwise stated, are drawn by myself from nature

Respectfully submitted,

CHARLES V. RILEY,

*State Entomologist.*

ST. LOUIS, MO., March 14, 1877.

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# NOXIOUS INSECTS.

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## CURRENT AND GOOSEBERRY WORMS.

The Current and the Gooseberry, though not among the choicest of our fruits, yet possess, with their peculiarly sub-acid or their spicy flavor, qualities which make them invaluable for the manufacture of jellies and conserves, and render them most grateful and healthful in the hot summer months. Their cultivation is somewhat neglected in Missouri, and though more general farther north and east it has there fallen off within the past twelve or fifteen years, principally on account of the increase of those insects which injuriously affect the plants.

Those, therefore, who desire to successfully grow the Current and Gooseberry must familiarize themselves with, and learn how to effectually deal with the insect enemies which attack them. Chief among these are several so-called "worms" which prey upon the leaves, and by repeatedly defoliating the bushes, not only prevent the fruit from maturing, but eventually cause the death of the plant. In some sections the injury has been so serious that the culture of these fruits has been abandoned.

It is the common but misleading practice for writers in our horticultural journals to refer to any of these insect enemies of the Current and Gooseberry as THE Current Worm or THE Gooseberry Worm, as though there was but a single species injurious to these plants; whereas, in reality, there are quite a number of species that affect them in stem, leaf and fruit. As a rule each requires a different mode of treatment, according to its habit; but I shall here consider only the three principal leaf-feeders, which may all be destroyed by one and the same means.

These three species formed the subject of an editorial article published some years ago in the *American Entomologist* (Vol. II, No. 1)

which is now so scarce that it cannot be had in the market. The portion on the Gooseberry Span-worm was written by myself; that on the Currant worms by my associate, B. D. Walsh, the facts in possession of either being interchanged, as was our custom. While I am able to record some interesting observations made since that time, the article was to that extent exhaustive of the subject, that I shall quote liberally from it, rather than recast the facts in different language.

Notwithstanding that the Currant and Gooseberry differ so much in general appearance—the former being a smooth-stemmed shrub, bearing its flowers and fruit in a raceme, while the latter has, as a rule, thorny and prickly stems, and bears its berries singly—they are placed by botanists in the same genus (*Ribes*). Our common Garden Gooseberry (*Ribes grossularia*) was imported from Europe, but we have four wild species commonly found in the Northern States; and besides these four there is a Californian species, the Showy Gooseberry (*R. speciosum*) which is sometimes cultivated as an ornamental plant in our gardens, for the sake of its fine, deep-red, pendant flowers. On the contrary, our common Red Currant (*R. rubrum*), of which the White is a mere variety, is indigenous in the more Northern States, from New Hampshire to Wisconsin, though also a native of Europe; while on the other hand, the Black Currant of our gardens (*R. nigrum*) is a European plant, considered by botanists to be distinct from the American wild Black Currant (*R. floridum*). Besides these, we have three other currants peculiar to America, the Prostrate or Fetid Currant (*R. prostratum*) found in cold Northern woods, the Missouri or Golden Currant, (*R. aureum*) and the Red-flowered Currant (*R. sanguineum*) both of which are natives of the Far West, and are cultivated chiefly for ornament.

These botanical details will not be uninteresting by way of preface to what follows; for the three worms to be described, while they are found indiscriminately on the Red Currant and Gooseberry, are not found on the Black Currant.\*

Our Wild Black Currant has a Lepidopterous borer peculiar to it; while the common Currant-borer of our gardens (*A. tipuliformis*) which belongs to the very same genus; and the Common Currant Plant-louse (*Aphis ribis*) both confine their attacks to the Red Currant, and do not affect the Black Currant or the Gooseberry. These facts are not only very interesting as showing the slight discrimination

---

\* Mr. Saunders records (*Can. Ent. II. 147*) having found the Imported Currant-worm in the act of feeding not only on the Black Currant, but also on the Plum; but the fact that all larvae which he endeavored to rear on such leaves eventually died, shows how exceptional and abnormal is their feeding on those plants, and that they cannot, in the true sense of the word, be considered Black Currant or Plum feeders.

which insects sometimes make between plants of the same genus; but they are of much practical importance, as a knowledge of the peculiar tastes and preferences which insects frequently manifest for different species, or even different varieties of plants, will be of much value in guiding us what to plant.

## THE GOOSEBERRY SPAN-WORM—*Eufitchia\** *ribearia* (Fitch.)

[Ord. LEPIDOPTERA; Fam. GEOMETRIDÆ.]

### ITS NATURAL HISTORY.

In the month of May, in the latitude of St. Louis, gooseberry bushes, and more seldom currant bushes, are sometimes suddenly

[Fig. 1.]



GOOSEBERRY SPAN-WORM:—a, b, larvæ; c, pupa.

stripped of their leaves by a yellow, black-spotted worm which generally remains unnoticed during the early part of the month, when small and hidden by the foliage. It is the most common and destructive of the gooseberry leaf-eaters in Missouri, and, being a looper or span-worm, is at once distinguished, by its mode of progression, from the other worms to be mentioned. When full grown it measures about an inch, and is of a bright yellow color, with lateral white lines and numerous black spots and round dots, as shown in the accompanying figures. The head is white, with two large black eye-like spots on the outer sides above, and two smaller ones beneath. The six true legs are black and the four prolegs yellow. It drops readily by a web and attains its growth from the end of May to the middle of June, when it descends to the ground and either burrows a little below the surface or hides under any rubbish that may be lying there; but in neither case does it form any cocoon. Shortly after this it changes to a chrys-

\*This insect was originally described by Fitch under the generic name *Abraxas*, with a question as to the correctness of the generic reference. It has also been very generally referred to *Ellopiia*, but Dr. Packard in his recent admirable *Monograph of the Geometrid Moths*, very properly defines the genus under the name *Eufitchia*, the insect in question being the only species belonging to it.

alis (Fig. 1, c), of the usual shape, and shining mahogany-brown in color. After remaining in this state about fourteen days, it bursts the chrysalis shell, and in June and the forepart of July appears as a moth (Fig. 2).

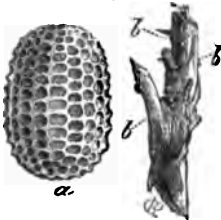
[Fig. 2.]



Female Moth of Gooseberry Span-worm.

rather gauzy and shaded with faintly dusky or leaden-colored spots. These are arranged in no very distinct pattern, but form a more or less conspicuous band across the outer third of all the wings, and give a soiled appearance to the basal portions. The spots are always largest and most intense in the middle portion of each wing. The under surface repeats the upper, and the legs, body and feelers are somewhat brighter, or orange. In the male the feelers are feathered or ciliated; in the female they are simple. These moths may invariably be noticed hanging listlessly about the bushes two or three weeks after the worms have disappeared, and even where the latter have not been numerous enough to attract attention, the moths they have produced may generally be noticed in the month of June, moving with languid flight about the bushes, or darting somewhat more actively from place to place when disturbed. Like the rest of their family, they are nocturnal and, except when aroused, or in cloudy weather, usually remain quiet during the day. The females, soon after issuing from the ground, begin to lay their eggs, fastening them simply to the twigs and more permanent parts of the plant, and principally on the main stems near the ground and beneath the branches. The preference for the inner, more basal and protected portions of the plant, over the terminal or more exposed parts, I have found quite decided. From being laid singly and from possessing protective coloring, these eggs are with difficulty noticed, and have never hitherto been described. I had on several occasions, in years gone by, obtained what were evidently, from comparison with those found in the ovaries, the eggs of this species, but not until last spring did I succeed in hatching therefrom the larvæ, under conditions where they could be

[Fig. 3.]



EGG OF GOOSEBERRY SPAN-WORM:—a, enlarged; b, natural size.

watched, or in getting the females to lay in confinement. The egg is irregularly ovoid, slightly compressed, 0.7 mm. long,  $\frac{2}{3}$  as wide, pale bluish-green in color, with irregular, sub-hexagonal reticulations, so as to give a rather deeply pitted appearance something like the surface of a thimble, there being 15 or more longitudinal rows of these pits. It reminds one in fact of the pitted grain of the berry of *Atropa belladonna*. It is attached as often on one side as on end.

This insect is single-brooded, and the eggs are exposed to all the heat of summer, and the vicissitudes of winter, without losing their vitality. At length, when the proper time arrives, and the Gooseberry and Currant unfold their leaves so as to afford plenty of food, these eggs hatch, and in little more than three weeks the worms attain their full larval development.

#### HOW IT SPREADS.

Owing to the above peculiarity and to the fact that the eggs are attached to the permanent parts of the plant where they are with difficulty seen, the species is frequently carried in the egg state upon transplanted bushes from one neighborhood to another; which accounts for its sudden appearance in parts where it was before unknown.

#### A NATIVE SPECIES.

This Gooseberry Span-worm is a native American insect, not to be found on the other side of the Atlantic. There is, however, an allied species (*Abraxas grossulariata*), which in Europe infests Currant and Gooseberry bushes in much the same manner as our species does here. The two insects were at one time supposed to be identical, but the European species is at once distinguished by its black, white and yellow markings in the larva and imago states; and by forming its chrysalis above ground. It used to be very common in a dearly-loved garden at Walton, England, where, in watching its metamorphoses I first, as a child, became interested in insect life—the bright colors and striking pattern of the species in all stages, and its external habit, making it a most convenient object for study.

#### ITS PAST HISTORY.

Our species undoubtedly fed originally on some one or all four of our indigenous gooseberries, but after the introduction of the European gooseberry it very soon manifested its preference for the latter, and, under the new conditions, multiplied so rapidly as soon to become a serious pest. The depredations of this insect in some of the Eastern States, particularly in New York and Pennsylvania, date back a great number of years. In the West it was first noticed by myself (*Prairie Farmer*, July 16, 1875) in the neighborhood of Chicago, in 1862, where for a few years afterward it multiplied to an injurious extent.

In Missouri, my attention was first called to it in May, 1868, by Mr. T. W. Guy, then living at Glenwood. His gooseberry bushes had been entirely denuded of their leaves by it. Mr. Huron Burt of Williamsburg, on May 30, 1870, sent me specimens of the worms, with the statement that they had been defoliating his gooseberry bushes, and



that where the foliage was insufficient they would finish up on the fruit. Quite frequently, since then, I have in my travels found the gooseberry bushes in the eastern counties of the State defoliated by this pest; but it is seldom complained of in the western counties, and Mr. Walsh, in the course of twelve years collecting, met with but a solitary specimen of the moth, near Rock Island, Illinois, although the wild gooseberry was abundant in the woods in that locality.

#### IT PREFERS THE GOOSEBERRY TO THE CURRANT.

This insect shows a decided preference for the Gooseberry, always attacking that plant first when growing side by side with currant bushes. Hence, and because it is generally preferable to apply the popular name of an injurious insect to the state in which it commits its depredations, I have given it the distinguishing term of "Gooseberry Span-worm," though Fitch originally called it the American Currant Moth. The term "Currant Geometer or Measuring Worm" has subsequently been used without any particular reason.

#### THE MOTH IS CLOSELY IMITATED.

There is another moth common in Missouri and in most parts of the country, which in flight and general appearance bears so close a resemblance to the parent of our Gooseberry Span-worm that the two at first sight are easily confounded, and furnish a remarkable illustration of the fact that insects differing widely in structural details often have stamped upon them the same general appearance, where what naturalists understand as "mimicry" could apparently have had nothing to do in bringing about the resemblance. I refer to a little moth often seen fluttering about the Fragrant Sumach (*Rhus aromatica*) on which its larva perhaps feeds. It has precisely the same color and very much the same markings and differs from the Gooseberry moth only in details of venation, in the simple feelers in both sexes and in the somewhat smaller size, more rounded and more diaphanous wings. It has been referred to an entirely different Family (*Bombycidæ*), but evidently belongs to the Geometers.

#### PARASITES.

No parasite has been mentioned by previous writers as attacking the Gooseberry Span-worm, but I have reared an undescribed Tachinid fly from its pupa.

#### REMEDIES.

Many different applications have been used to kill this worm. A correspondent of the *Country Gentleman* (June 17, 1869) mentions having used skim milk with good success. The Gooseberry Span-worm of Europe, already referred to, is fought with a decoction of

Elder leaves boiled until the liquid becomes black. Into this is then mixed an equal quantity of tobacco water. Fox-glove leaves are also used for the same purpose. Sulphide of potassium in dilute solution (one part in 500) is also used in France, and even air-slacked lime is found useful when the worms are young. The same remedies would doubtless apply to our species, but white hellebore, as I shall presently recommend it for the other worms, is most available and most effective, though less satisfactory than when applied to them. The habit which the worms have of letting themselves down by a web when disturbed, renders hand picking quite effectual if done when they are young. It will be most effectual where the bushes are well-trimmed. By shaking these with a forked stick, and then passing the stick under the suspended worms, the latter may be drawn onto the ground and crushed. It is a good plan also to dig around the bushes, after the worms have entered the ground to transform, so as to expose them or the chrysalides to birds. Where practicable, poultry may be used to good advantage in this destruction.

Three other Span-worms\* are mentioned by Packard and Saunders as infesting currant bushes; but none of them are spotted and marked as that under consideration, and none of them have ever been known to multiply to the same injurious degree. They all occur in Missouri, and the moths are more often met with than the worms.

### THE IMPORTED CURRANT WORM—*Nematus ventricosus*† Klug.

[Ord. HYMENOPTERA; Fam. TENTHREDINIDÆ].

The two insects next to be treated of belong to a class of leaf-feeding worms not heretofore noticed in my Reports, namely, the false caterpillars or slugs. With the exception of the wood-boring Horn-tails (*Uroceridæ*), and a few of the Gall-flies (*Cynipidæ*), they are the only insects of their order that injure vegetation to any considerable extent. The false-caterpillars are so named on account of their general resemblance to the ordinary caterpillars

\**Angerona crocataria* (Fabr.), *Amphydasis cognataria* Guen., and *Endropia armataria* (H.-S.).

†As with so many other insects, this species has received many names, and through the carelessness of describers, and the tendency to erect species on the most trivial differences, it has become almost impossible to unravel its nomenclature. Mr. Walsh has, however, endeavored to do so (*Pract. Ent.* I, 125). The name which I employ, and which has been very generally accepted, was given to it in 1819 by Klug; but as, according to Seibold, Klug's name was what we call a mere museum name, and Scopoli had described the ♂ as early as 1763 (*Entomologia carniolica*, 289) by the name of *ribesii*, the sticklers who allow nothing but the strictest law of priority carried back to its utmost limit in point of time, will have a chance to fly in the face of modern authors who have employed Klug's name, by adopting Scopoli's, albeit his *ribesii* was a description of but one sex and not of the species. In 1828 the ♂ was described as *affinis* and the ♀ as *trimaculatus* by St. Fargeau; and it is under this last name that Dr. Fitch published an extended article on the species (*Trans. N. Y. St. Agr. Soc.* 1857, pp. 909-932)—strangely overlooking the sexual distinctions after they had been clearly pointed out by Mr. Walsh. It has at different times been christened *ribis* by two different authors; also *ribesii grossularis* and *grossulariatus*.

of moths or butterflies. They are easily distinguished from the latter, however, by never having less than six, and often as many as eight, pairs of prolegs; whereas no true caterpillar has ever more than five pairs. The prolegs also differ structurally in lacking the rim of minute hooks which characterizes those of true caterpillars. The perfect insects are termed Saw-flies, from the peculiar saw-like structure of the ovipositor, which will be more particularly referred to further on.

The species under consideration is one of the most destructive members of the family, and though not so widespread as the Gooseberry Span-worm, it is far more troublesome than any other currant insect in most of the Eastern States. I have neither met with it, nor been able to trace its occurrence, with any degree of certainty, in Missouri; but as there is good evidence that it occurs already in Illinois, and Mr. Jno. W. Byrket found it in 1870 around Indianapolis, Ind., I have thought best to forewarn and forearm those of our citizens who are interested in berry culture, by laying before them a full account of it.

#### ITS INTRODUCTION AND SPREAD.

It first began to attract attention in this country around Rochester, N. Y., about the year 1857—the first explicit reference to it being found in the *Rural New Yorker* for July 24, 1858. It was generally supposed to have been imported along with some gooseberry bushes from Europe, by the celebrated Rochester nurserymen, Messrs. Ellwanger and Barry: but Mr. Barry informed me, while at his beautiful place in 1871, that it was first known to occur around Toronto, in Canada, before it appeared around Rochester.

“In nine years time, besides colonizing in other directions, it had gradually spread to Washington county, N. Y., on the east side of the Hudson River—a total distance of about 225 miles. Thus, as it appears, it traveled at the average rate of some twenty-five miles a year, establishing a permanent colony wherever it went, and not passing through the country as a mere moveable column of invaders. In 1860 or '61 it appeared at Erie, in the N. W. corner of Pennsylvania. In 1864 Prof. Winchell found it at Ann Arbor, Michigan. In 1866 it was generally distributed over the N. E. counties of Pennsylvania. And, judging from a conversation which we had in October, 1868, with Mark Carley, of Champaign, in Central Illinois, this gentleman must have had it in great numbers upon his currant bushes in the summer of that year. At all events he described the worm which had infested his bushes as being green, with many black spots, and as not being a looper.

"But besides the principal centre of distribution at Rochester, N Y., this Currant-worm seems to have been imported from Europe at one or two other points in the Eastern States, and, as at Rochester, to have spread therefrom as from a focus. Unless our memory greatly deceives us, Mr. Geo. Brackett, of Maine, described this same insect many years ago, as existing in that State, though he gave it a different specific name, and was not at all aware that it had been introduced from the other side of the Atlantic. We also heard of it in the summer of 1867, from Mr. A. H. Mills, of Vermont, as being very destructive in his neighborhood. Not improbably, it was independently imported at other points in the East. Wherever it is introduced it spreads with great rapidity, and as there are two broods every year, it soon multiplies so as to strip all the currant and gooseberry bushes bare and utterly ruin the crop, besides eventually destroying the bushes, unless proper measures be taken to counteract it."

According to Dr. Fitch, who, in the article already alluded to, has given a very full account of its spread over the Western States, it kept the bushes so destitute of leaves in most of the gardens at Watertown, N. Y., that in three years they were nearly or quite dead.

It now occurs in all the New England States, and according to Mr. Wm. Saunders, throughout Canada from Halifax to Windsor.

#### ITS NATURAL HISTORY.

The perfect insects come out of the ground soon after the leaves of the current and gooseberry bushes put forth in spring. The female lays her eggs along the principal veins on the underside of the leaf, (Fig. 4, 1). These eggs, though but slightly attached, yet increase in

[Fig. 4]



IMPORTED CURRANT WORM:—Leaf showing eggs (1), and holes which the young worms make (2, 3.)

bulk after deposition, as is the case of all Saw-fly eggs known to me, when inserted into the plant-tissue. Such swelling has been explained heretofore solely on the principle of endosmosis, and if such were the only explanation it would strongly argue that the eggs in this instance, must be slightly inserted in the leaf tissue. Indeed Siebold, in some elaborate observations on this insect, which I shall more particularly refer to further on, finding that the eggs shrivelled and died in measure as the leaves upon which they were

deposited dried up, investigated the subject very carefully, and

declares that the female ruptures, with her weak saws, the epidermis of the leaf-ribs, and thus brings the surface of the egg in very close connection with the exposed parenchyma.\*

He further remarks that the rupturing or scratching (*Verletzung*) which *Nematus ventricosus* causes in ovipositing is "probably confined to the epidermis and may therefore be easily overlooked." This may account for the fact that Mr. Saunders† states, after carefully looking into this matter, that he is fully satisfied that the eggs are not embedded in the leaf tissue at all, but fastened very slightly to the surface. Upon subsequently questioning Mr. Saunders more particularly about it, he wrote (May 25, 1874): "Whatever Siebold may say, I cannot help. My microscope does not show *me* the egg as pushed through the epidermis—it appears distinctly on the surface—it is very different from the Raspberry saw-fly in this respect." Dr. A. S. Packard, Jr., also states (*Embryological Studies* in Mem. Peabody Ac. of Sc., Vol. 1, No. 3,) that the eggs are simply glued to the surface, and this is the experience of all other American writers on the subject. The investigators named are all most careful observers and good microscopists; yet either there is error somewhere, or else, which is an interesting possibility, the insect has been modified in habit since its introduction to America.

While in the majority of cases in America, as observed by Saunders and Packard, the abortive saws of the female may not rupture the epidermis; in some cases, however, they certainly do; for in most but not all the specimens which I have examined, I have detected the slight rupturing mentioned by Siebold. It is still plainly discernible in a dried leaf now before me from Mr. J. A. Lintner, of Albany, N.Y., and yet containing well formed eggs that were parasitized. Nevertheless, when made, it is so slight as to be altogether insufficient to support the egg without the adhesive fluid that accompanies it. The eggs, while attached, appear no more inserted than are those of the genus *Lyda*, and differ materially in this respect from those of all other Saw-flies known to me.

Siebold himself remarks that there can be, with such slight skinning of the epidermis, but little vital intercourse between the egg and the plant, and the facts that I have recorded as to the swelling of the eggs of our Katyids when fastened to perfectly dry and dead substances (Rep. V, 124,) would indicate that the swelling is not due solely to endosmosis from the attached parts of the plant, but depends on another principle, difficult to analyze, but evidently more or less atmospheeric.

\*Beitr. zur Parthenogenesis der Arthropoden, 1871, p. 123.

†Am. Entomologist II, 274; Can. Ent., II, 112.

Mr. Saunders has found as many as 101 eggs on three contiguous leaves.

The eggs hatch within a week or ten days according to the weather, into pale 20-legged larvæ with a large dull whitish head,

[Fig. 5.]

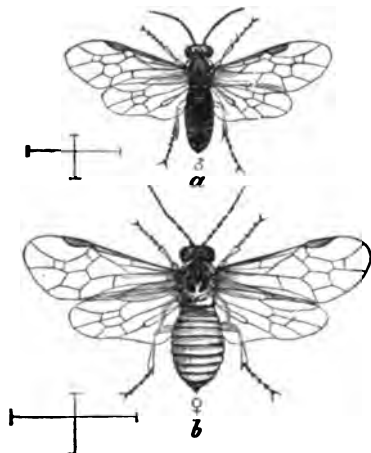


IMPORTED CURRANT WORM:—*a, a, a*, larvæ; *b*, a magnified joint of body, showing black tubercles.

having each side the black spot so characteristic of Saw-fly larvæ belonging to the same genus. The color soon becomes green, and as the worms molt they acquire black, shiny spots on the body, and a black head. After the last molt the spots are shed again, and the color is entirely grass-green, except the dark head-spots, and a yellowish tinge on the first and the anal joints. In the annexed Figure 5, *a, a, a, a*, show larvæ of different sizes in different positions; and *b* gives an enlarged view of one of the abdominal joints in profile, so as to exhibit the position of the black spots. "When full-grown the larvæ are about three-quarters of an inch long, and from their greatly increased size, make their presence readily known by the sudden disappearance of the leaves from the infested bushes. Shortly afterwards, having attained a length of fully three-quarters of an inch, they burrow underground, generally beneath the infested bushes, or, if there are many leaves lying on the ground, simply hide under those leaves. In either case they spin around themselves a thin oval cocoon of brown silk, within which they assume the pupa state." Frequently, however, as has been fully proved by Mr. Saunders, and as has been recorded by European observers, they form their cocoons in the open air, on the bushes, or under any extraneous shelter that is at hand. "About the last week in June or the first part of July, or occasionally not until the beginning of August, the winged insect bursts forth from the cocoon and emerges to the light of day; when the same process of coupling and laying eggs is repeated. The larvæ hatch out from this second laying of eggs as before, feed on the leaves as before, and spin their cocoons as before; but the perfect fly from this second brood does not come out of the cocoon till the following spring, when the same series of phenomena is repeated." At least such is the case ordinarily, though a third generation is sometimes produced.

Mr. Saunders has given some reason to believe that a few of the second brood of larvæ may exceptionally hibernate as such.\* This in itself is not impossible, but cannot, by any means, be looked upon as proved. The impression rests on the fact that on the 31st of May,

[Fig. 6.]



IMPORTED CURRANT WORM:—a, male; b, female fly, the hair lines showing nat. size.

1869, he found a cocoon attached to a bag which he had tied on a gooseberry bush on the 22d of the same month. We all know that the Gooseberry is one of the first plants to blossom and leaf, and that in all ordinary seasons a worm such as our Currant-worm would have ample time to acquire full growth by the last of May at London, Ont. In point of fact Mr. Saunders himself found worms feeding the very next year in the very same locality, as early as the 10th of May.† Yet he could not suppose these had hibernated because he at the same time found eggs upon the leaves, some of which must have been laid two weeks earlier. The flies are known to issue in April even in Northwestern New York, where, though on about the same latitude, the opening of spring is later than at London, Ont. Moreover, in the very first article appearing upon the insect in this country (*Rural New Yorker*, June 24, 1858), the worms are described as appearing “in succession occasionally from March till October, but in greatest numbers in June.” And, allowing the spring of 1869 to be unusually late, I cannot see why a cocoon found the last day of May should not have been made by a worm hatched from an egg deposited by an early developed fly; for it is more likely that an early female should deposit a few eggs on the yet unfolded buds than that the worm should, as such, weather the winter's severity except when shielded by its cocoon.

“From the drawings of the male and female‡ fly given herewith (Fig. 6), the reader will see at once that the two sexes differ very widely. This is very generally the case among the Saw-flies, and it is a remarkable and most suggestive fact that, when this takes place, the body of the male is almost invariably darker than that of the female. Nor does our species, as will be observed at the first glance, form any exception to the rule.” Indeed, as with several other species and

\**Can. Ent.*, II, pp. 16, 48.

†*Ibid.*, p. 112.

‡The abdomen in this cut should show only 9 joints.

notably the saw-flies (genus *Lophyrus*) which affect the White Pines and which will be treated of further on, the body of the male is almost entirely black and that of the female almost entirely yellow.

#### PREVENTIVE MEASURES.

"The mode in which this Currant-worm has been transmitted, first from the European nursery to the American nursery, and afterwards all over several States of the Union, can be easily explained. As has been stated just now, it usually passes the autumn and winter in the ground under the bushes, where it has fed, housed in a little oval cocoon from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch long. Hence if, as often happens, infested bushes are taken up in the autumn or early in the spring, with a little dirt adhering to their roots, and sent off to a distance, that dirt will likely enough enclose a cocoon or two. A single pair of cocoons, if they happen to contain individuals of opposite sexes, will be sufficient to start a new colony. The first and probably the second year the larvæ will not be noticed; but increasing as almost all insects do, unless checked from some extraneous source, in a fearfully rapid geometric progression, by the third or fourth year they will swarm, strip the bushes completely bare of their leaves, and ruin the prospect for a good crop of fruit. Of course, like other winged insects, they can fly from garden to garden in search of a suitable spot whereon to deposit their eggs; so that any point where they have been once imported becomes, in a few years, a new centre of distribution for the immediate neighborhood.

"Nurserymen and all others, importing Gooseberry and Currant bushes from a distance, should be particularly careful, before they plant them, *to wash the roots thoroughly in a tub of water, and burn or scald whatever comes off them.* Any cocoons, that may happen to be hidden among the dirt attached to the roots, will then be destroyed."

By adopting these precautions the dissemination of so mischievous a pest throughout the country, and especially its introduction into Missouri, might be prevented for many years to come.

#### REMEDIES.

White hellebore, which can be had at a comparatively low price, has proved an infallible remedy for this worm.

"All that is required is to dust it lightly over the infested bushes, taking care to stand to windward during the operation, as if taken into the nostrils it excites violent sneezing. For this purpose, the best plan is to put the powder into a common tin cup, tying a piece of very fine muslin over the mouth of the cup; or the powder may be simply



enclosed in a bag of muslin of convenient size. In either case, the apparatus must be fastened to the end of a short stick, so as to avoid coming in too close quarters with it. It is best to select a moderately still day for the operation; as the powder is so exceedingly fine that on a windy day it is apt to get wasted."

It may be more safely and agreeably, and just as effectually applied in solution, by syringe or sprinkler, in proportion of one pound of the powder to 20 or 25 gallons of water.

"To test the genuineness of the article, a very small pinch of it should be applied to the nose. If it is good and has not lost its strength by keeping too long, it will immediately produce a tingling sensation in the nostrils; if it does not produce this effect, it is worthless and should not be used. There is every reason to believe that in those cases where men have used White hellebore to kill Currant Worms without any preceptible effect, they had been deceived into buying an adulterated or worthless drug. Although, like almost all our medicines, hellebore, in large doses, is poisonous, yet in minute doses there is no reason to be afraid of it; for, according to Dr. Fitch, it has long been in use as the basis of those snuffs, which are designed to excite violent and continued sneezing."

The following interesting experience with hellebore in solution, and with hot water, is given by Mr. Saunders in the *Canadian Entomologist* (Vol. II, pp. 13-15), and will prove instructive.

The larva of *Nematus ventricosus*, alas, too well known under the popular designation of "currant-worm,"\* has been very abundant in this neighborhood during the present season. In my own garden it has been a continual fight as to who should have the currant and gooseberry bushes, the worms or their rightful owner. During the early part of summer, anticipating their attack, I was on the lookout for them and by timely doses of hellebore, preserved the foliage with but little damage. In about a fortnight later, having omitted inspection for a few days, I was surprised to find the bushes being stripped again; and this time the enemy had got so far ahead as to damage their appearance considerably. Another prompt dosing of hellebore brought relief. After this I hardly ever found all the bushes entirely free from them; a walk around the garden would reveal a few here and a few there, and I was perpetually hand-killing and brushing off these smaller detachments. Four times during the season I found it necessary to apply hellebore freely, for the foes were a legion.

During the middle of August, being occupied with other matters, the garden was neglected for a few days, when on visiting it again on the 19th, I found many of the bushes entirely leafless, and the foliage remaining on the others was rapidly disappearing. I felt discouraged and began to have some misgiving as to whether hellebore was after all such an unfailing panacea for this almost universal pest as we had supposed. I resolved if possible to satisfy myself fully on this point, and having mixed about 1½ oz. of powdered hellebore with a pail of water, was ready to proceed. I selected a leaf from two bushes, marked them and counted the number of their inhabitants—one was occupied by *forty-four* worms of different sizes, crowding it above and below, and it was about half eaten; the other leaf had twelve nearly full grown on it. Having transferred the mixture of hellebore and water to a watering pot, the bushes were sprinkled with it. I returned to examine the results in three-quarters of an hour, and the leaf which at first had forty-four on it, had now only two, and these were so far exhausted that they were unable to eat, and could hardly crawl,

\* After this admission, it seems to me that the popular distinguishing term of "Imported Currant-Worm," first given it by Walsh, is preferable both to that of "Imported Gooseberry Saw-fly," given by Mr. Saunders (Rep. Ent. Soc. Ontario, 1871), and to that of "Currant Worm and Saw-fly," bestowed by Dr. Fitch.

while on the other leaf out of the twelve there remained three, but in the same enfeebled condition. All around under the bushes, the ground was strewn with the fallen foe, and I felt perfectly satisfied that entire reliance might be placed on this means of defense.

I did not anticipate such speedy action on the part of the hellebore, or should have returned to the examination sooner, and the bushes were so entirely cleared, that, excepting on one I had reserved for another experiment, I had no means of repeating the dose.

There was one thing that struck me as somewhat remarkable, the portion of leaf on which the greatest number were feeding, appeared to be of the same size as before the hellebore was applied; if smaller I could not perceive it. When the leaves dry, which have been sprinkled with liquid, a very thin coating of the powder, more or less regular, is found over them, and I had always supposed that death resulted from eating a portion of the leaf thus coated. Such is undoubtedly the case when the hellebore is applied dry, but in this case a meal however small made by *forty-four caterpillars* on half a leaf, must have materially diminished it. I am disposed to believe then that the death of most of these must have resulted from their imbibing or absorbing some of the liquid as soon as applied. Many of them showed symptoms of the violent cathartic action of the remedy, having a mass of soft excrement hanging to the extremity of their dead bodies.

I had reserved one bush, on which were a good number, for another experiment. It sometimes happens, especially with those who live in the country, that hellebore is not at hand when the worms are first observed at work, and a few days' delay in procuring it is perhaps unavoidable. In such cases the bushes may be entirely leafless, before the remedy can be applied. Hot water suggested itself to my mind as likely to be of some service, and being also an article readily procurable in every home. It is well known that many plants will bear such an application without injury, provided the heat is not too great. Taking some in a watering pot, a little hotter than one could bear the hand in, I showered it plentifully on the affected bush, and it was amusing to see how the caterpillars wriggled and twisted and quickly letting go their hold, fell to the ground, which was soon strewn with them. After the first excitement produced by the sudden heat was over, they remained as if wishing to "cool off" before commencing work again. A few did not recover from the application, but most of them were soon as active as ever.

Now what I would suggest is this, that where the hellebore cannot be at once procured, no time should be lost in applying the hot water, and when once on the ground the creatures may have the life trodden out of them by the foot, or beaten out with the spade or some other implement. In any case many of them would never reach the bush again, for enemies beset them on every side.

If used in powder, a perforated tin cylinder, such as is commonly used for the purpose in England, will be found useful to push into the bushes and reach every part thereof, and particularly the under sides of the leaves. It is generally made about  $2\frac{1}{2}$  inches wide and 10 inches long. The cylinder has a fixed bottom, with a socket to receive a handle and a brace to strengthen the socket, and a tight-fitting cover completes it.

As the well known editor of the *American Agriculturist* writes from his own experience: "A pound of white hellebore, costing about forty cents, will clean any ordinary garden, and keep it clean for a season. If applied in the liquid form with a good syringe, the whole labor need not exceed an hour. There is great satisfaction in seeing clean bushes and clean clusters, and though it may be an evidence of depravity, we confess to a feeling of consolation at the sight of the enemy, stupefied, coiled up, and laid out in rows upon the brown earth. We always did have a private interpretation of Cowper's sentiment about 'needlessly setting foot on a worm.'"

Numerous other remedies might be detailed, some of which, as copperas water, decoction of poke weed root, etc., have doubtless proved

more or less effectual, but most of which are founded on isolated experiments and on results due to other causes which the experimenters did not understand. Indeed, one can scarcely pick up a horticultural journal without finding during the summer months some new remedy for THE Currant-worm recommended. But nothing equals those I have referred to, and even carbolate of lime, which is quoted by many authors as having been used with success by Dr. E. Worcester, of Waltham, Mass., and as being less disagreeable, less costly and perfectly safe, was, after thorough trial, found by Mr. Saunders, who is himself a chemist, and doubtless obtained the pure article, to be of little or no avail. The only manner in which it can be successfully employed, as Mr. M. W. Armington, of Providence, R. I., maintains, is by sprinkling it on the ground, and then shaking the worms down, when, if of full strength, it will prevent most of them from getting back.

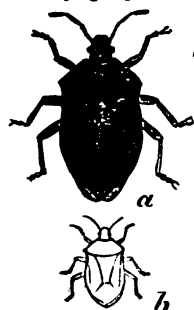
From the habit which belongs to this species of laying the eggs in large numbers on a single leaf, we can employ another means of counter-working its injuries which will not apply to the other two worms. The newly hatched larvæ can find "plenty of food without wandering off, and they have the habit when very young of boring small holes through the leaf, as shown at No. 2 in Figure 4, and when they become a little older, holes that are a little larger, as shown at No. 3. It is evident that such holes as these may be readily recognized, and the leaf be carried, larvæ and all, far away from any currant or gooseberry bushes, and left to winter there, or—to make assurance doubly sure—thrown into the fire. If, however, the young larvæ are removed a few rods away from any plant belonging to the botanical genus *Ribes*, they will be sure to die of starvation. For they cannot feed on anything else, any more than the common Locust-borer can live on an apple tree. As the eggs are laid in such large groups, there will be but a few leaves bearing these newly hatched larvæ to remove from every bush," and early in the season they will be found principally on the lower parts of the bushes, nearest the ground.

"Wherever this Currant Worm has been introduced, there has prevailed, from some cause or other, a popular superstition that the currants grown upon the infested bushes are poisonous. This is a mere delusion. They may be, and very probably are, unwholesome, just as any other fruit would be perhaps more or less unwholesome, if grown under such unnatural conditions as to seriously affect the health of the tree; but we have the authority of Dr. Fitch, himself a physician, for believing that the common notion on this subject is entirely erroneous."

## NATURAL ENEMIES.

It is not probable that any of the natural enemies which attack this insect in Europe have been imported with it into this country; but several of our indigenous species have learned to prey upon it. Besides such indiscriminate feeders as ants and some of the cannibal beetles which Mr. Saunders has observed to attack the worms when they fall from the bushes, or are the least helpless or injured, it is attacked while on the bushes and in vigorous health by a Half-wing Bug, first noticed at this work by the same gentleman. This species (*Podisus placidus* Uhler, Fig. 7, *a*, enlarged; *b*, natural size) which may be called the Placid Soldier-bug, is marked with yellowish-brown

[Fig. 7.]



PLACID SOLDIER-BUG:  
*a*, enlarged; *b*, natural  
size.

and dark brown, and attacks the worms in the same well known manner in which the Spined Soldier-bug spears and sucks to death the larvæ of the Colorado Potato-beetle. Mr. Walsh bred from this Currant worm a small Ichneumon-fly (*Brachypterus microp-terus*, Say) which has such small wings that it much resembles an ant. Mr. C. J. S. Bethune also reared from its cocoon another Ichneumon-fly (*Hemiteles nematinorus*, Walsh)\* closely allied to that which infests our common Bag Worm (Rep. I, p. 150.) This same fly was captured a number of years ago by Mr. Walsh around Rock Island, Illinois, "and as the Im-

ported Currant Worm has not as yet been introduced into that region, we must conclude that this Ichneumon-fly could not have been imported into America from Europe along with this Currant Worm, but that in all probability it is an indigenous species. Hence we have additional proof that, under certain circumstances, native American parasites can, and actually do, acquire the habit of preying upon European insects when the latter are imported into America. It is certain, however, that they will not do so in all cases without excep-tion; for although the Wheat Midge, or Red Weevil, as it is incorrectly termed in the West, invaded our shores some forty or fifty years ago, not a single parasite has yet been discovered to prey upon it in this country, although there are no less than three that prey upon it in Europe."

Lastly, Mr. J. A. Lintner has discovered that even the eggs are inhabited by a minute Hymenopterous parasite which, I believe, remains undescribed; and he informs me that he has also bred a *Tachina*-fly from the larva.

\* *Can. Entomologist*, II, page 9.

## IT PRESENTS A FORCIBLE EXAMPLE OF ARRENOTOKY.

Parthenogenesis, or the production of offspring by virgin females, has long been recognised as a zoölogical fact, occurring with many of the lower forms of animal life, and not unfrequently with insects. With many of the latter, *e. g.*, the plant-lice, as we have so fully seen in these Reports in the case of the Grape Phylloxera, it is the normal form of reproduction; while with many other insects, as with some, and perhaps with most gall-flies (*Cynipidæ*), it occurs regularly at every alternate generation. It also occurs occasionally with insects which normally cannot or do not multiply without direct sexual intercourse, as in the common Mulberry Silk-worm. As I have remarked elsewhere: \* "What in some species is the exception, becomes the rule in others, of which the hive-bee is an example. The male element may be said to possess all degrees of potency in its influence on the reproductive functions of its immediate issue, as the embryo in ova not directly fecundated, attains all degrees of development before death. In cases of parthenogenesis it is potent enough—vital enough, to cause full development of the offspring for one or more generations, though in the majority of instances, and especially where this mode of reproduction does not occur as a rule, this offspring is most frequently male." In other cases females instead of males are produced. The power possessed by the virgin females of certain species to produce male offspring, has been called Arrenotoky by Leuckart; while the parthenogenetic production of females has been designated as Thelytoky by Siebold, who has elaborately shown† that our Imported Currant Worm possesses the former power, and that the unimpregnated eggs hatch into larvæ which produce male flies. Further, that this is the rule with all its eggs non-impregnated, which seem to hatch fully as well as those which are impregnated. This power, as Siebold shows, had been observed as far back as 1831, by Robert Thom, who, in Loudon's *Gardener Magazine* (Vol. VII, p. 196), states, that "the ova of the female produce caterpillars, even when the male and female flies are kept separate;" but who, loth to believe in anything so extraordinary as *lucina sine concubitu* must have seemed in those days, thought that there was "reason to suspect that there is a connection between the male and female caterpillars," from the fact that these, as is so often the case with the Saw-fly larvæ, are not unfrequently found with their tails curled around each other. Thus arrenotoky occurs in our Currant Worm (Fam. *Tenthredinidæ*), as it does in the Hive-bee (Fam. *Apidæ*). It is also known to occur among wasps

\* *Am. Naturalist*, Vol. VII, p. 520.

† *Beitr. zur Parthenogenesis*, &c., 106—120.

(*Vespidæ*). With certain moths belonging to the family *Psychidæ*, and with certain crustaceans, only thelytokic parthenogenesis takes place.

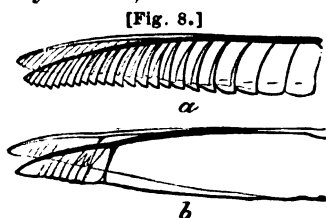
IT ALSO FURNISHES AN INTERESTING INSTANCE OF DEFUNCTIONATION OF SPECIAL PARTS.

• As already remarked (ante p. 8), the Saw-fly family to which our insect belongs, derives its name from the peculiar structure of the ovipositor, which looks like the blade of a saw.

“Under the microscope—and in the larger species, even under a good lens—it will be seen that the lower edge of each of the two horny blades, of which this instrument is composed, is furnished with very fine teeth, the shape of which differs in different species. With this tool the female fly saws into the texture of the leaf or of the twig, in which the instinct of each particular species teaches it to deposit its eggs; and—wonderful to relate—it was demonstrated long ago that the eggs thus deposited inside the substance of the plant, which is to supply the future food to the young larva as soon as it hatches out, actually grow and derive nourishment from the sap of that plant, so as often to attain double their original size.\* Hence we may see at once why the eggs are deposited by this group of insects in such situations as these, and why Nature has provided the female Saw-flies with saws in their tails. But—as the thoughtful reader will perhaps have already observed—our Currant-worm Fly lays its eggs upon the surface, and not in the interior of the leaf, glueing them thereto by some adhesive fluid, which it secretes for that purpose.” At the most in some instances, she scratches the epidermis. “And we may add that there are a few other Saw-flies—such for example as the Rosebush Saw-fly (*Selandria rosæ*)—which do the very same thing, and consequently, as well as our species, can have little use for any saws at their tails. If, therefore, as was formerly the almost universal belief of the scientific world, each species, whether of animals or of plants, was independently created, with all its present organs and instincts, and not derived, as is the more modern doctrine, from the gradual modification of pre-existing species through a long series of geological ages, we might naturally expect our Currant-worm Fly, and the Rosebush Saw-fly and such few other Saw-flies as practice similar modes of laying their eggs, to have no saws at all. For why should Nature, when she is creating new species, bestow an instrument upon a particular species which has no occasion whatever to use that instrument? In point of fact, however, all female Saw-flies, no matter what their habits

\* I have already stated my opinion that this enlargement is not due solely to nourishment from the sap.

may be, possess these saws, though in one genus (*Xyela*) the saws, instead of being hard and horny throughout, are said to be soft and membranous above and below;\* and in certain other Saw-flies, though they are as hard and horny as usual, they are degraded and—to use the technical term—‘defunctionated.’ This will be seen at once from an inspection of the following drawing (Fig. 8), copied by ourselves from nature and very highly magnified. Here *a* represents the two saws of the female of the Willow-apple Saw-fly (*Nematus salicispomum* Walsh), which belongs to the very same genus as our Currant-worm Fly. Now, we know that the female of the Willow-apple Saw-fly depos-



OVIPOSITORS OF SAW-FLIES :—*a*, perfect; *b*, imperfect.

its a single egg inside the leaf of the Heart-shaped Willow (*Salix cordata*) about the end of April, probably accompanying the egg by a drop of some peculiar poisonous fluid. Shortly afterwards there gradually develops from the wound a round fleshy gall, about half an inch in diameter, and with a cheek as smooth and rosy as that of a miniature apple; inside which the larva hatches out and upon the flesh of which it feeds. In this particular case, therefore, as the female fly requires a complete saw with which to cut into the willow leaf, nature has supplied her with such saws, as is seen at once from Figure 8, *a*. Now look at Figure 8, *b*, which is an accurate representation under the microscope of the two saws of our Currant-worm Fly. It will be noticed at the very first glance that, although the blade of the saw is there, the teeth of the saw are almost entirely absent.

What, then, are we to make of these and many other such facts? Manifestly the teeth of the saw are in this last species degraded or reduced to almost nothing, because the female fly, laying her eggs upon the surface of the leaf, and not cutting into the substance of the leaf, as does the female of the Willow-apple Saw-fly, has no occasion to perform any sawing process. But why, it will be asked, is the blade of the saw there in its normal size, and with the exception of the degradation of the saw-teeth, as completely developed as in the other species, when such a tool cannot be necessary for the simple process of glueing an egg on to the surface of a leaf? The modern school of philosophers will reply, that this is so, because the primordial Saw-fly, in the dim far-away vista of by-gone geological ages, had a complete pair of saws, and our insect is the lineal descendant of that species, slowly and gradually modified through a long series of years, so as to

\*See Westwood's *Introduction*, II, p. 95.

conform more or less to the change in its habits. On the other hand the old school of philosophers, who believe that every species was independently created, will argue that this is so, in order to 'complete the System of Nature,' and 'carry out the Plan of the Creation,' and 'give full and free expression to the Thoughts of the Creator.' Possibly this may be the true solution of the difficulty; but—and we say it in no irreverent spirit—what should we think of a Potter, who made all his teacups, without exception, with handles; those for which handles were required with complete ones such as you could put your finger through, and such cups as were not wanted to have any handles at all, with solid unperforated ones, such as would be nearly useless? And what should we say, if the Potter's friends were to gravely argue, that he took all this unnecessary trouble in order 'to complete the System of Art,' and 'carry out the Plan of the Tea drinker,' and 'give full and free expression to the Thoughts of the Potter?' ”

#### DESCRIPTIVE.

I repeat the following descriptions as originally drawn up by Mr. Walsh from many specimens, as the publications in which they occur are not now very accessible.

As I have already stated, the larva is pale green just previous to spinning its cocoon, having thrown off the tubercled skin with the last larval molt. Indeed this habit of throwing off the armed or ornamented larval skin before preparing for the pupa state is almost universal with the Tenthredinidæ. The comparatively naked condition, between the full grown larval and pupal states, may be likened to the semi-pupa state of some other insects, for the Saw-fly larvæ in this condition shrink somewhat in size and do not feed, as far as I have observed, though they may be active for a few days.

**NEMATUS VENTRICOSUS**—*Larva, nearly mature.*—Length  $\frac{1}{2}$  inch. Pale green, verging on yellow towards the tail. Head black, polished, with numerous short hairs proceeding from minute tubercles. Mouth, except the mandibles, dingy green. Joints of the body above with rows of small shining black tubercles placed crossways, and each bearing a hair in the less mature specimens, but in the largest and most mature ones bearing no hairs at all, except the larger tubercles on the sides. First joint behind the head with a single row of dorsal tubercles; joints 2 and 3 each with a double row, the anterior one curved forwards in the middle in a semicircle; joints 4—12 with a treble row; the anal plate black, polished, and prolonged at each posterior angle in a slender acute thorn, and having, besides the triple row of tubercles before it, a group of six or eight tubercles on each side of and partly before it. A longitudinal row of larger lateral black tubercles on joints 2—12, one on each joint, beneath which there is a geminate black tubercle above each proleg; all these tubercles bearing many hairs. Legs black, the sutures pale green. Prolegs fourteen, pale green, all but the two anal ones with a few minute black dots towards their tip in front. Joints 4 and 11 without prolegs.



*Female Fly.*—General color of body bright honey-yello. *Head* black, with all the parts between and below the origin of the antennæ, except the tip of the mandibles, dull honey-yellow. Antennæ brown-black, often tinged with rufous above, except towards the base, and beneath entirely dull rufous, except the two basal joints; fourths as long as the body; joint 3, when viewed laterally, four times as long as wide, joints 3-5 equal in length, 6-9 very slowly shorter and shorter. In two females the antennæ are 10-jointed, joint 10 slender and  $\frac{1}{2}$  as long as 9. *Thorax* with the anterior lobe above, a wide stripe on the disk of each lateral lobe which is very rarely reduced to a mere dot, or very rarely the whole of each lateral lobe, a spot at the base and at the tip of the scutellum, the two spots sometimes confluent and very rarely subobsolete, a small spot at the outer end of each cenchri and a geminate small spot transversely arranged between the cenchri, the tip of the metathoracic scutellum, the front and hind edge above of what seems the 1st abdominal joint, but is in reality the hind part of the metathorax, or very rarely its whole surface above, and also the whole lower surface of the breast between the front and middle legs, or very rarely two large spots arranged crossways on that surface, all black. Cenchri whitish. *Abdomen* with joints 1 and 2 very rarely edged at tip with black. Sheaths of the ovipositor tipped more or less with black, the surrounding parts sometimes more or less tinged with dusky. The triangular membrane at the base of the abdomen above, whitish. *Legs* bright honey-yellow; all the coxæ and trochanters whitish; the extreme tip of the hind tarsi and the whole of the hind tarsi, brown-black. *Wings* glassy; veins and stigma brown-black, the latter as well as the costa obscurely marked with dull honey-yellow. In a single ♀ all three submarginal cross-veins are absent in one wing, and only the basal one is present in the other wing. In another ♀ all three are indistinctly present in one wing, and in the other only the basal one and a rudiment of the terminal one. In a single wing of two other ♀, the terminal submarginal cross-vein is absent. And in a single ♀ there are but three submarginal cells in either wing, precisely as in the genus *Euura*.—Length ♀ 0.22—0.28 inch. Front wing ♀ 0.27—0.33 inch. Expanse of wings ♀ 0.53—0.64 inch, (wings depressed).

*Male Fly.*—General color of body black. *Head*, with the clypeus and the entire mouth, except the tip of the mandibles, dull honey-yellow. Antennæ brown-black, often more or less tinged with rufous beneath, except towards the base; as long as the body, the joints proportioned as in ♀, but the whole antenna, as usual in this sex, vertically much more dilated, so that joint 3 is only  $2\frac{1}{2}$  times as long as wide when viewed in profile. *Thorax* with the wing-scales and the entire collar honey-yellow. Cenchri whitish. *Abdomen* with more or less of its sides, the extreme tip above, and its entire inferior surface honey-yellow. *Legs* as in ♀. *Wings* as in ♀. In two ♂ the middle submarginal cross-vein is absent in both wings, so that if captured at large they would naturally be referred to the genus *Euura*. In two other ♂ this is the case in one wing only. Another ♂ has but the basal submarginal cross-vein remaining in each wing. And in two other ♂ the terminal submarginal cross-vein is absent in one wing. Length ♂ 0.20—0.22 inch. Front wing ♂ 0.23—0.25 inch. Expanse of wings ♂ 0.44—0.54 inch, (wings depressed.)

“Described from 22 ♂ and 13 ♀, 3 ♂ and 1 ♀ of the spring brood. The fact of two ♀, contrary to the established character of the genus *Nematus*, having 10-jointed instead of 9-jointed antennæ is a variation of a kind of which no other example in the whole family of Sawflies is on record. Had such a specimen been captured at large, instead of being bred along with a lot of normal ♀, from the same lot of larvæ taken from the same lot of bushes, it would probably have been made the basis of a new genus.”

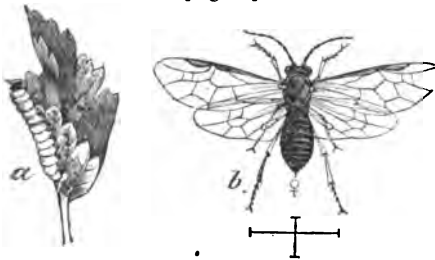
THE NATIVE CURRANT-WORM—*Pristiphora grossulariæ* Walsh.

[Ord. HYMENOPTERA; Fam. TENTHREDINIDÆ.]

WHEREIN IT DIFFERS FROM THE IMPORTED SPECIES.

“Like the Imported Currant-worm, this worm produces a Saw-fly, which, however, belongs to a different genus, (*Pristiphora*), chiefly distinguishable from the other one (*Nematus*) by the front wing lacking what is technically termed the ‘first submarginal cross-vein.’ In Figure 9, *b*, we give a magnified drawing of the female of this fly, and

[Fig. 9.]

NATIVE CURRANT-WORM:—*a*, larva, nat. size; *b*, fly, enlarged.

if the reader will look at this drawing and compare it with that of the Imported Currant-worm Fly (Fig. 6, *a* and *b*), he will see that there is in each of them but one cell, or ‘pane’ as it might be termed, on the upper edge of the front wing towards its tip. This is technically called ‘the marginal (or radial)

cell.’ Now let the reader look a second time at these two figures, and he will see that, underneath this ‘marginal cell’ there is a tier of four cells in the one genus (*Nematus*) and a tier of only three cells in the other genus (*Pristiphora*), the first or basal cross-vein being absent or ‘obsolete’ in the latter, so as to leave the first or basal cell extravagantly large. These three or four cells, as they underlie the ‘marginal cell,’ are technically known as ‘the submarginal (or cubital) cells;’ and upon the difference in the number and arrangement of these marginal and submarginal cells depends to a considerable extent the generic classification of the Saw-flies. For example, in another genus (*Euxura*), which is closely allied to the two of which we present drawings, there are, as in the second of these two, one marginal and three submarginal cells; but here it is the *second*, not the *first* (or basal) submarginal cross-vein that is obsolete; so that here it is the *second*, not the *first* (or basal) submarginal cell that is extravagantly large, being formed in this last case by throwing the typical second and third cells into one, and in the other case by throwing the typical first and second cells into one, just as by removing the folding doors two rooms are thrown into one.

“Persons who are not familiar with this subject are apt to suppose, that the pattern of the curious network on every fly’s wing varies indefinitely in different individuals belonging to the same species.

As a general rule, there is scarcely any variation at all in this matter, each species and even each genus having its peculiar pattern, and all the individuals belonging to a particular species having the network of their wings as exactly similar as the different photographs executed by a daguerreotypist from the same negative plate. You may take, for instance a thousand, honey-bees, and you will find that in the front wing of every one of them there are exactly one marginal and three submarginal cells, which, however, are all of them shaped very differently from the corresponding cells in any Saw-fly, though all the thousand honey-bees will be found to have them shaped exactly alike, cell corresponding to cell, as in any particular issue of \$5 bank notes, vignette corresponding to vignette and medallion die to medallion die. Among the Saw-flies, indeed, as was noticed in the description of the Imported Currant-worm Fly, the pattern of the wing-veins in different specimens of the same species varies occasionally a little; but this is the exception and not the rule, and is philosophically of high interest, as showing how one genus may in the course of indefinite ages change gradually into another genus.

"The Native Currant-worm Fly differs in another remarkable point from the Imported Currant-worm Fly. The sexes are here almost exactly alike in their coloration, and with the exception of the legs of the male being a little more marked with black than those of the female, it would not be very easy to distinguish one from the other, but by the usual sexual characters. Hence we have not thought it necessary to give a figure of the male as well as of the female; whereas in the Imported species the two sexes differ so essentially in their coloration that, as already observed, a figure of one would give scarcely an idea of the other."

#### ITS HABITS.

"The larva of the Native Currant-worm Fly (Fig. 9, *a*) is of a uniform pale green color, without those black dottings which are always found, except after the last molt, in the Imported species. Before the last molt, indeed, the head is of a uniform black color, though it afterwards has a good deal of green in front; but the body remains throughout of the same immaculate green shade. It differs also in its habits from the Imported species, never, so far as we can find out, going underground to spin its cocoon, but always spinning that cocoon among the twigs and leaves of the bushes upon which it feeds.

"This species agrees with the other one in being double-brooded, the first brood of larvæ appearing about the end of June and the

beginning of July, and the second brood from the middle of August to the forepart of September. But instead of the larvæ of the second brood lying underground in their cocoons all winter, they burst forth in the fly state from the beginning to the middle of September. Hence the female fly is compelled to lay her eggs upon the twigs instead of on the leaves; for if she laid them upon the leaves, as is the habit of the Imported species, the second laying of eggs, which has to pass the winter in that state, would fall to the ground along with the leaves in the autumn, and the young larvæ would starve when they hatched out next spring before they could find their appropriate food. Consequently, in the case of this species, we cannot apply the method of counterworking the other species which has been already referred to. For we have particularly remarked that the very young larvæ were not gathered in great numbers upon one particular leaf—as with the Imported species—but were distributed pretty evenly over the whole bush. Neither did they bore the singular holes through the leaf (Fig. 4), which render the other species so easy of detection when young.

“As will have been observed from the figures given above, the Native species, besides the differences already noticed, is only about two-thirds the size of the other in all its states. Like the other, it infests both currant and gooseberry bushes, but appears rather to prefer the Gooseberry. Indeed there can be little doubt that our native Gooseberries formed its original food-plant; for many years ago we captured a single specimen in the neighborhood of Rock Island, Illinois, in woods remote from houses, where the wild gooseberry was pretty abundant, and there was no wild red currant.” The species was described in 1866 by Mr. Walsh, “from numerous specimens found stripping the gooseberry and currant bushes in Davenport, Iowa; and it has since been reported to us by Miss Marion Hobart, of Port Byron, N. Illinois, as so abundant in her neighborhood in 1868 on the gooseberries as to completely defoliate them three times over, so that she inferred—but we think erroneously—that there were three distinct broods of them, one generated by another. Mr. Jas. H. Parsons, of Franklin, N. Y., has in a letter to us expressed the same opinion with regard to the Imported species. Probably both parties have been deceived by what is a very common occurrence with many leaf-feeding larvæ. There is often a warm spell early in the year which causes a moiety of the eggs of a particular brood to hatch out. This is taken for the first brood. Then follows a long spell of cold weather, which prevents the other moiety of the same batch of eggs from hatching out till perhaps a month or six weeks afterwards.

When at last the moiety does hatch out, it is considered by inexperienced persons as a distinct second brood. There is also very frequently a great variation, probably from similar causes, in the time at which the same batch of pupæ burst forth into the perfect winged state. For example, out of a lot of 31 cocoons, of the second brood of the Imported Currant-worm Fly, all received by us at the same time from Dr. Wm. M. Smith of Manlius, N. Y., most of the flies came out between June 26th and July 11th, but a few did not appear till towards the latter end of July and one lingered on till August 13th."

As I have captured the female fly in East St. Louis, and as worms which, from the description, could not well belong to any other species, were noticed by Mr. T. W. Guy, of Sulphur Springs, on his gooseberry bushes in 1870, there can be little doubt that the species occurs with us, as it is generally distributed throughout the country. Mr. L. D. Votaw of Eureka, has also reported to me the occurrence on his place of a "small green and unspotted worm" on his currant bushes.

#### REMEDIES.

The same as for the preceeding species.

#### DESCRIPTIVE.

I reproduce, from the *Practical Entomologist* (Vol. I, p. 123), Mr. Walsh's original descriptions, drawn up from many specimens.

**PRISTIPHORA GROSSULARIÆ**—*Immature larva*.—Length not quite reaching  $\frac{1}{2}$  inch. Body pale green, with a rather darker dorsal line, and a lateral yellowish line above the spiracles, the space below which line is paler than the back. Anal plate and pro-legs immaculate. Head black, not hairy. Legs brown, except the sutures.

*The mature larva* measures  $\frac{1}{2}$  inch in length, and differs in the head being pale green, with a lateral brown-black stripe commencing at the eye-spot, and more or less distinctly confluent with the other one on the top of the head, where it is also more or less confluent with a large central brown-black spot on the face. The legs are also green, with a small dark spot at the exterior base of each, and a similar spot or dot before the base of the front legs.

*Imago*—♀—Body shining black, with fine, rather sparse punctures. *Head* with the entire mouth, except the anterior edge of the labrum and the tip of the mandibles, dull luteous. Labrum transverse and very pilose. Clypeus short, squarely truncate, immaculate. Antennæ  $\frac{3}{4}$  as long as the body, joint 3 three and a half times as long as wide, joint 4 fully  $\frac{1}{2}$  shorter than joint 3, 5—9 very slowly shorter and shorter; brown-black above, beneath dull luteous, except joints 1 and 2, which are black, tipped below with luteous. *Thorax* with the wing-scales honey-yellow and the cenchri whitish. *Abdomen* with the basal membrane whitish; ovipositor honey-yellow, its sheaths black. *Legs* honey-yellow, or sometimes pale luteous, with the six tarsal tips of the tibiæ and of the tarsal joints 1—4, pale dusky. *Wings* subhyaline, tinged with dusky; veins black; costa honey-yellow; stigma dusky, edged all round with honey-yellow, especially below. In a single wing of two females only out of forty-nine, the first submarginal cross-vein, which in this genus is normally absent, is quite distinct; and in a

single wing of five other females, traces of it are visible on holding the wing up to the light. Length ♀ 0.17—0.21 inch. Front wing ♀ 0.19—0.23 inch. Expanse ♀ 0.41—0.45 inch, (wings depressed.)

The ♂ differs from the female only as follows: 1st. The antennæ are a trifle longer, and as usual vertically more dilated, joint 3 being only  $2\frac{1}{2}$  (not  $3\frac{1}{2}$ ) times as long as wide. 2d. The coxæ, except their tips, and the basal half of the femora, are black; and in the hind legs the extreme tip of the tibiæ and all but the extreme base of the tarsus, are dusky. Anal forceps honey-yellow. Length ♂ 0.17—0.18 inch. Front wing ♂ 0.17—0.19 inch. Expanse ♂ 0.35—0.38 inch, (wings depressed.)

### THE STRAWBERRY WORM—*Emphytus maculatus* Norton.

[Ord. HYMENOPTERA; Fam. TENTHREDINIDÆ.]

In connection with the foregoing account of the Imported and Native Currant Worms, it will be well to give the history and habits of a worm of the same family, which is the most conspicuous, if not the most common defoliator of that more profitable and more generally cultivated fruit—the Strawberry. This is the Strawberry Worm (*Emphytus maculatus* Norton) the natural history of which was first given by myself in the *Prairie Farmer* for May 25, 1867.

The species appears to have a wide range, as I have met with it in many parts of Illinois and our own State, have received it from

[Fig. 10.]



STRAWBERRY WORM: Ventral view of pupa; 2, side view of same; 3, enlarged sketch of perfect fly, the wings on one side detached; 4, larva crawling, natural size; 5, perfect fly, natural size; 6, larva at rest; 7, cocoon; 8, enlarged antenna, showing joints; 9, enlarged egg.

Iowa, and it is reported from various sections in the East and from Ontario. In 1874, Prof. Bessey, of the Iowa Agricultural College, reported it as devouring the Strawberry plants in many parts of that State, and Mr. Hoffmeister, of Fort Madison, wrote me that in many sections the plants had to be plowed under in consequence of its devastations. Early in spring numerous flies, as shown in Fig. 10, 3

may be seen hanging to, and flying about the vines, in fields which have been previously infested. They are dull and inactive in the cool of the morning and evening, and at these hours are seldom noticed.

They are of a pitchy black color, with two rows of large, transverse, dull, whitish spots upon the abdomen. The female, with the saw-like instrument peculiar to the insects of this family, deposits her eggs by a most curious and interesting process, in the stems of the plants, clinging the while to the hairy substance by which these stems are covered. The eggs are white, opaque, and 0.03 of an inch long, and may be readily perceived upon splitting the stalk, though the outside orifice at which they were introduced is scarcely visible. They soon increase somewhat in bulk, causing a swelling of the stalk, and hatch in two weeks—more or less according to the temperature—and during the early part of May the worms attract attention by the innumerable small holes they make in the leaves. Their colors are dirty yellow and gray-green, and when not feeding, they rest on the under side of the leaf, curled up in a spiral manner, the tail occupying the center, and fall to the ground at the slightest disturbance. After changing their skin four times they become fully grown, when they measure about  $\frac{3}{4}$  of an inch.

At this season they descend into the ground, and form a very weak cocoon of earth, the inside being made smooth by a sort of gum. In this they soon change to pupæ, from which are produced a second brood of flies by the end of June and beginning of July. Under the influence of July weather, the whole process of egg depositing, etc., is rapidly repeated, and the second brood of worms descend into the earth during the forepart of August, and from their cocoons, in which they remain in the caterpillar state through the Fall, Winter, and early Spring months, till the middle of April following, when they become pupæ and flies again, as related.

#### REMEDIES.

The same remedies recommended for the Currant Worms will apply here. They are more satisfactorily employed, however, and after the worms have been made to fall to the ground, a mixture of warm water and kerosene will destroy them as quickly as anything.

#### DESCRIPTIVE.

**EMPHYTUS MACULATUS:**—*Imago*.—Color piceous, with two rows of dull, dirty white, transverse spots upon the abdomen. Wings hyaline; veins black; eyes and eyelets black; antennæ black and 9-jointed. Legs brown and almost white at the joints. No particular difference of coloring in the sexes. Average expanse of female 0.53 inch; length, exclusive of antennæ 0.24 inch.

*Larva*.—Length 0.60–0.65 inch when full grown, having changed but little in appearance from time of birth. Somewhat translucent. General color, pale, dirty yellow, with a glaucous shade along dorsal and sub-dorsal regions, inclining in most cases to deep blue green on the thoracic segments. Minutely wrinkled transversely. Venter light glaucous. Legs—6 pectoral, 14 abdominal, and 2 caudal—of the same

color. Head of a more decided yellow than body, with usually a dark brown spot above, one nearly of the same size at the upper front, and two rather smaller ones at each side—joined by a brown line—the anterior spot being lower down than the other. In certain specimens these two are blended, and there is but a triangular spot on the top of the head, while the depth of shading on the body is also variable.

*Pupa*—Of a dingy, greenish-white color, the members being somewhat paler than the body.

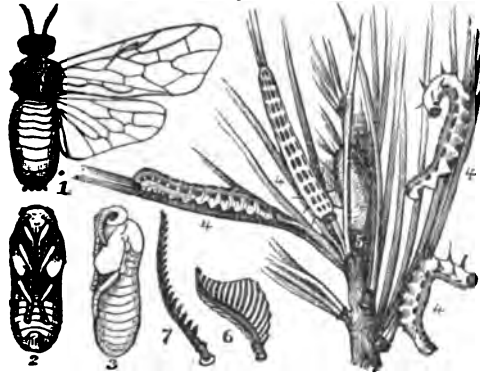
Numerous specimens in all states examined.

### ABBOT'S WHITE PINE WORM—*Lophyrus Abbotii* Leach.

[Ord. HYMENOPTERA; Fam. TENTHREDINIDÆ.]

Belonging to the same Saw-fly family as the preceding species, are certain false-caterpillars which are very injurious to pines. They belong to the genus *Lophyrus*, so named from the plume-like antennæ of the males. In Germany whole forests of pine and fir trees have

[Fig. 11.]



ABBOT'S PINE WORM:— Perfect fly magnified; the left wings removed; 2 and 3, enlarged pupæ; 4, larvæ in its natural position; 5, cocoon natural size; 6, magnified antenna of male; 7, magnified antenna of female.

known by myself some ten years since (*Prairie Farmer*, Nov. 10, 1866, May 25, 1867, May 2, 1868, and *P. F. Annual*, 1869), and are more fully given herewith.

Abbot's White Pine Worm has been more frequently sent to me, with complaints of injury, from Indiana and Illinois. Yet it occurs over a wide extent of country, and in the columns of the *Rural New Yorker* and *American Agriculturist* frequent records of its injuries in the East are to be found of late years. While its injuries are reported from the northern part of Missouri, it seems not to occur in the southern part of the State.



The following passage from a letter received from Mr. Jos. T. Little, of Dixon, Ills., in 1869, gives a very good account of the working of the insect :

I find them on one clump of pines on my lawn, and in a small lot of pines in my nursery. Late last Fall, I discovered that those same trees had been attacked by some worm or other, and that the foliage had been stripped off the young shoots, which shoots dried up this Summer. We had a very hard freeze on the night of October 8th, the mercury being at 30 degrees above zero; but still the worms do not seem to be affected by the weather. They are very sluggish at any time in their movements. I have Scotch and Austrian Pine, Arbor Vitæ, Balsam Fir, Norway, Spruce and Red Cedar, in the immediate vicinity of the White Pines, but they are unmolested.

In 1872 Mr. A. W. Barber of Lancaster, Wis., lost some fine trees by its injuries, and it was complained of in many sections the past year. This worm, which is dingy white in color, with black head and black spots (Fig. 11, 444) has, in every instance that has come to my knowledge done its principal injury late in the Fall, and may frequently be seen feeding into November, or after the ground is frozen about an inch deep. When full-fed, these larvæ enclose themselves in oval, bright bronze, or gold-colored cocoons, spun up between the needles, or in whatever sheltered situation is at hand. Sometimes the cocoon is formed upon the tree, but more often among the fallen needles and other debris and shelter beneath it. Within these cocoons the worm is very tightly packed, and remains till toward the following Spring, or even late Summer, when it becomes a pupa, with a dusky dorsal line and pale brown eyes (Fig. 11, 2, 3). The flies issue two weeks afterwards, and the sexes differ so much that they would be declared distinct insects by the uninitiated. The male, with the exception of the underside and tip of the abdomen, is jet black, his average length 0.23 inch, and the expanse of his wings, 0.47 inch. The female measures 0.30 inch, and expands 0.65 inch. She is of a honey-yellow, with the head and thorax somewhat darker than the abdomen; the thorax blackish at the upper posterior sides, and the abdomen having a lighter lateral stripe, with four or five blackish spots above it. These distinguishing features are much more striking in the living, than in the dried cabinet specimens. The antennæ in both sexes are black, those of the male 21-jointed and with 17 long and 17 shorter plume-like branches: those of the female serrated, with one or two joints less than the male, and 17 serrations.\*

\*Fitch, in the brief and summary account given of *L. Abbotti*, says that the antennæ are 17-jointed; while another species, which he named *L. Lecontei*, and which he supposed was the parent of worms, the description of which answers perfectly to the above, he says, has 21-jointed antennæ. I have examined dozens of *L. Abbotti*, and the antennæ are usually 21-jointed in the ♂, and 19-jointed in the ♀, counting the scape or bulb as 2, and the terminal enlargement as 2. In reality, however, the terminal joint frequently appears single, and the number of joints is found to vary in different individuals in the same species, when large material is examined. In *Abbotti* I have individuals with antennæ having 18, 19, 20 and 21 joints respectively; in *Abietis* the number varies from 21 to 23 in ♂, and from 14 to 18 in ♀, and in *Lecontei* they are usually 21 in ♂ and 19 in ♀—always counting the scape as 2. *Abbotti* and *Lecontei* cannot, therefore, be distinguished by the joints in their antennæ, as, with others, I myself once believed they could, and the relative number of antennal joints in this genus loses all specific value.

The eyes and eyelet are black, and the legs pale rufous in both sexes; while the wings are hyaline with prismatic colors. In escaping from the cocoon, the fly makes a clean, somewhat spiral cut at one end, always leaving a small hinge for its prison door to swing on.

These flies, in confinement, soon die without ovipositing, which indicates that they nourish on something out-doors. As with most saw-flies, the perfect insects are quite irregular in coming out of the ground, many of them issuing in May, but others not till toward the end of Summer. On opening cocoons that had passed the Winter I have found many yet containing the larva the latter part of June, while others of the same brood had become flies six weeks before. The species has generally been considered single-brooded; but as I have had the eggs laid as early as May, and the young worms feeding the latter part of that month, two broods are not improbably produced. In ovipositing, the female saws beneath the epidermis on one of the flat sides of the leaflet and pushes into the slit an egg, which is whitish, ovoid, 0.8 m.m. long on an average. As the egg swells it forms a conspicuous bulging of the epidermis, and the mouth of the slit opens and exposes more and more a portion of the egg. The young worm has the black head and black-ringed thoracic legs of the full grown individuals, but otherwise differs essentially from them, the body being uniformly pale and unspotted. The worms are more or less gregarious throughout their existence, and seldom leave a twig or branch till they have completely stripped it. Inconspicuous at first, they are seldom noticed till the denuded branches attract attention, and when, after the last molt, they strip a tree with astonishing rapidity. They have a habit of throwing back the head and tail when disturbed, and if violently shaken many of them will fall to the ground. They also use the tail end of the body to grasp more firmly the leaflets upon which they feed. This is the worm described by Fitch as the possible larva of *Lophyrus LeContei*, and the real larva of this last will be described further on.

#### NATURAL ENEMIES.

The reason that this Pine-worm abounds at times and then suddenly disappears, is that it is extensively preyed upon by a parasitic Ichneumon fly, belonging to the genus *Limneria*. The species, which I have also bred from some wax-feeding larva (probably *Ephestia zeæ*) does not fully accord with any of the descriptions of Norton, Cresson, or Provancher. I therefore briefly define it herewith:

**LIMNERIA LOPHYRI**, N. Sp.—♀, length 0.30—0.35 inch. Head and thorax black with silvery white pile. Antennæ piceous, more than half as long as body; but slightly paler toward tip; bulbous either yellowish or rufous. Ocelli either rufous or black. Mandibles, palpi, front and middle coxæ trochanters and tibiæ, pale yellow. Tegulæ almost white. Abdomen, with faint pile, rufous, the petiole and sides of next joint usually blackish. Hind legs rufous, the base of tibiæ and of tarsi paler.

♂ somewhat smaller, and with more black on the abdomen.

Four ♂'s, 12 ♀'s bred from larvæ of *Lophyrus Abbottii*.

#### REMEDIES.

As evergreens suffer more from defoliation than deciduous trees, it is essential, during the proper season, to scan them very closely every few days where this insect is known to prevail. When the worms are noticed, a syringing of hellebore water, or a dusting of fresh air-slacked lime, while the tree is bedewed, will destroy them. Care should be taken to prevent their injuries by clearing the ground around the trees late in the Fall, and burning the fallen needles and rubbish, with such cocoons as may be among them.

#### DESCRIPTIVE.

**LOPHYRUS ABBOTII**:—*Larva*—Average length 0.80 inch, though many will measure about an inch. A soft, dingy, white worm, having often a greenish or bluish line superiorly. On all joints but the first, which is entirely white, two oblong square black spots along the back, and another somewhat rounder spot each side. These become somewhat diffuse on the three latter joints, forming on the last a single black patch. Three black thoracic legs, fourteen abdominal, and two caudal prolegs. Thoracic joints largest; the three last, smallest and tapering. Some are marked very regularly, while in others the white space on the back between the spots on joints 5, 6, 7 and 8, is much wider than between the others. This is probably sexual difference, since those thus marked are shorter, thicker, and of a yellower white than those regularly marked. After each change of skin the head is at first white like the rest of the body, with the usual eye-spots black. No markings while young.

### LE CONTE'S PINE WORM—*Lophyrus LeContei* Fitch.

[Ord. HYMENOPTERA; Fam. TENTHREDINIDÆ.]

Abbott's Pine Worm shows great preference for the White Pine and is seldom found on any other. It is, moreover, the most common and destructive species of the genus in our part of the country. Le-Conte's Pine Worm is, on the contrary, a more general feeder and prefers the coarse-leaved pines, such as the Austrian, Scotch and Pitch.

It is also most abundant in the East. It was first sent to me in October, 1867, by my friend A. S. Fuller, present editor of the *Rural New Yorker*, with the following letter.

I send you by to-day's mail a box of caterpillars found feeding on the Scotch and Austrian pines in my nursery. I can find nothing in Fitch or Harris which will enable me to identify them. These caterpillars have appeared in myriads in the last few weeks, and they do not pass a leaf, but take them all clean, old or young. If you can tell me all about this worm, please do so.

In a recent article (*R. N. Y.*, Nov. 25, 1876) referring to the injuries of what is evidently the same worm, though confounded with the preceding, Mr. Fuller writes :

We have already had some pretty hard frosts up to this date, Nov. 14, and yet a neighbor has just brought us some of these grubs taken from his pine trees. For several years past we have noticed that these Saw-fly larvæ remained upon the trees till very late in the Fall, and that it required a hard freeze to make them leave off feeding and descend to the earth, where they spin their cocoons among the old leaves and other vegetable matter.

These two pine worms have precisely similar habits, and, though bearing so close a resemblance to each other as to be easily confounded, LeConte's species is easily distinguished upon close examination by having the head reddish-brown, the spots differently shaped, and an extra row on each side. The female fly is distinguished by her black abdomen. For those interested the differences are presented more in detail in the following descriptions :

#### DESCRIPTIVE.

**LOPHYRUS LECONTEI**:—*Larva*—Average length, when full grown, about one inch. Color, dingy or yellowish-white, and void of any greenish or bluish hue. Dorsal black marks wider anteriorly than posteriorly, and usually broken transversely in the full grown individuals ; also further apart than in *L. Abbotii*. Lateral spots sub-quadrate, with an additional row of smaller black marks below them. Head shiny reddish-brown, with black eye-spot each side. Jaws tawny. Anal joint entirely black above. Venter and prolegs (14 abdominal and 2 anal) immaculate. Thoracic legs black, with white joints. When young it is without marks, and some of the full-grown specimens have them more distinct than others.

*Pupa*—Undistinguishable, except in the average larger size, from that of *L. Abbotii*.

*Imago*—The male fly can scarcely be distinguished at first sight from that of the other species, though the average size is somewhat greater, and the brown parts, viz.: venter, and tip of abdomen above, are of a somewhat deeper rufous-brown. The antennæ are more often and regularly 21-jointed than in *Abbotii*.

The female is distinguished, however, by her body being jet black above, except a small brown patch at the extremity and a transverse line of the same color just below the thorax ; and by her wings being smoky instead of hyaline. Venter with a black longitudinal line, more or less intense, each side. Thorax and head as in *Abbotii*, if anything, a little deeper in color. Average length 0.40, and expanse 0.70, though some will measure 0.50 inch and expand 0.82 inch.

There are several other American Saw-flies belonging to the same genus (*Lophyrus*) whose larvæ doubtless feed upon evergreens. One (*Lophyrus abietis* Harris) which is treated of by Harris, depre-

dates more particularly on the Fir, and, as a worm, is at once distinguished by being green, with darker green lines, but no spots, and by making a grayer cocoon. The larvæ of *Lophyrus Americanus* Leach, *L. Fabricii* Leach, and of *L. compar* Leach are unknown, and I suspect that some of these supposed species will prove to be but varieties of the three whose habits are here recorded.

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### THE COLORADO POTATO-BEETLE.

In some parts of Iowa, Wisconsin and the Northwest, this insect was very troublesome again the past year, but from one cause and another, though principally on account of the wet character of the past two summers, it attracted little attention in Missouri and the larger part of the Mississippi Valley. Yet on the Atlantic, and especially in the New England States, it has been a most fruitful theme of discussion and a constant object of warfare: nor have its doings ceased to interest Europeans. A pretty full record of its movements and of the more important and practical topics connected with it, has been published by me from year to year, and quite a demand has been made for back copies of these Reports from people in the East, and even from Europe. The editions of the earlier Reports, which contained most information on the subject have long since been exhausted, and in order to satisfy the demand, I prepared last Fall a small work entitled "Potato Pests," in which, with other insect foes of the Potato, the Colorado Potato-beetle is treated of at length. The work is published by the Orange Judd Co., of New York, and what I have to say below is mostly taken from it, and will serve to complete and complement what has previously been published in these pages.

#### SPREAD OF THE INSECT DURING THE YEAR.

During the past year, 1876, the insect has swarmed in most of the New England States, and especially on the sea shore. It has extended north around Montreal, and was especially abundant as far as Trois Rivières;\* while in its eastern progress it has overrun Con-

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\*L. Provancher in *Naturaliste Canadien*, Aug. 1876, p. 249.

necticut, Massachusetts, Vermont and New Hampshire and extended some distance into Maine. At Milestone and other places in Connecticut the beetles were washed ashore in such numbers in September as to poison the air, and the captain of a New London vessel found that they boarded him in such numbers while at sea that the hatches had to be closed. At many watering places, such as Cape May, Coney Island, Long Branch, Rockaway and Newport, they proved a great nuisance, being crushed and killed in large numbers by the continual promenading along the beach. The *New York Times* reported their impeding the progress of a train on the Central Railroad at Grinnell Station: "the rails were covered with them for a mile, and after a few revolutions of the drivers the wheels lost the friction and slipped as if oiled; \*\*\* they had to be swept off, and the track sanded before any progress was made."

The following items will further convey a good idea of the prevalence of the pest along the coast:

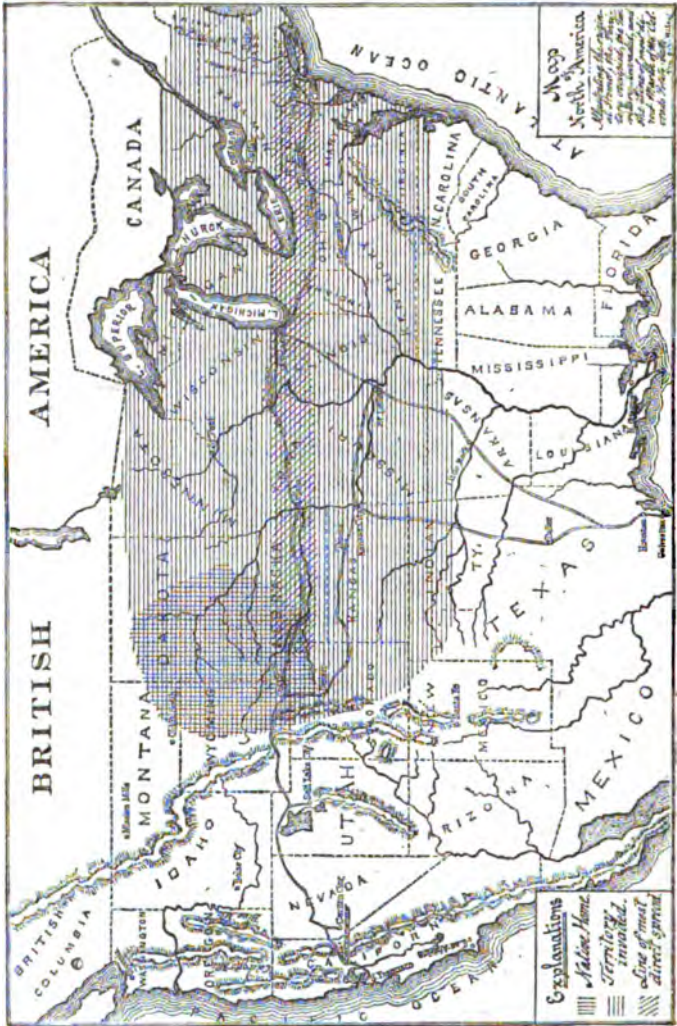
A day or two ago a party of gentlemen fishing near the middle of Long Island Sound, saw great quantities of potato bugs covering the surface of the water as far as the eye could reach. Every floating article, as well as the water, was packed with them, and many were clinging to eel-grass and sea-weed under the water. The wind was blowing from the south, and had probably carried them from the island, and they were being wafted toward the Connecticut shore. Inland on the island the bugs appear to be increasing in numbers, and, the potato vines being dry, they have attacked the egg-plants, pepper plants, and tomato vines.—[Correspondence of *N. Y. Tribune* from Huntington, L. I.]

The sea coast in the vicinity of this city and the shores of Long Island Sound are, at the present time, undergoing invasion by countless myriads of potato bugs. Where the insects come from is a mystery. They seem to cling to the floating sea weed and are left therewith on shore by the tide. At Coney Island and other points directly on the ocean, the bugs are most numerous, showing that they have been brought hither by sea currents, and by similar means have been swept into Long Island Sound. It seems hardly possible that the insects will now fail to reach the other side of the Atlantic, as they may find transportation on vessels, or be carried over in the drifting weed of the Gulf Stream.—[*Scientific American*, Aug. 5, 1876.]

While at Atlantic City, N. J., last Saturday, I noticed great numbers of the Colorado Potato-beetle flying about on the beach. I have never seen them so active before. Their unusual activity there may be the result of hunger, as there is an entire absence of the Solanaceæ, either wild or cultivated, in that vicinity.—[From a letter from G. W. Letterman, Allenton, Mo., July 22, 1876.]

There were twice as many potato-beetles as all other kinds put together. They evidently had been eastward bound, dropped into the ocean, and were brought back by the returning waves. We may infer also that many never reached the shore again from which they had made their departure, but were gobbled up by the fishes that sometimes plentifully inhabit those waters. Nor is this all: some distance up the Bay, and nearer the town of "Lewes," there is a tressel work—called the "Pier"—which extends a quarter of a mile out into Delaware Bay, upon which is a railroad track, upon which the cars of the Junction Railroad daily run to discharge their cargoes into sailing vessels and steamboats that periodically leave the outer end of the pier for New York, Philadelphia, Boston, Baltimore and other points. In the morning and the evening, when less commercial activity reigns, the pier is esteemed a capital place to fish. Well, all along this pier, from the shore to the extreme outer end, the ubiquitous potato-beetle was present, and at the outer end far more numerous than nearer shore. The State of Delaware at the time was full of these beetles, from one end to the other. The fruit-growers were shipping their peaches to market, and every cargo brought down from the interior also brought down a goodly number of the beetles, and it is

[Fig. 12].



not at all surprising that they should be carried aboard of the waiting vessels, and transported to other parts of this country, if not to Europe.—[S. S. Rathvon, in *Lancaster Farmer*, Aug. 1876.

#### RATE AT WHICH IT TRAVELED.

Walsh estimated, from the rate at which it traveled in the earlier history of its march, that it would reach the Atlantic in 1881. From subsequent calculations I placed the date at 1878, but it in reality touched the Atlantic seaboard at many different places in 1874. It thus spread at an average annual rate of about 88 miles. But the annual rate was by no means uniform. Earlier in the history of its march the rate was much lower, and until it got east of the Mississippi, did not average fifty miles. A glance at the accompanying map (Fig. 12) will suffice to show that the line of most rapid spread was along the line of greatest human travel and traffic. In fact, after it had reached New York it began to extend and swarm both north and south along the coast, before many of the inland counties on similar parallels were reached by the main line of the immense army.

#### HOW IT TRAVELED.

As the larva is sluggish and never leaves the plant from which it is hatched, except in quest of more food, until it is ready to pupate, all the journeys of this insect are necessarily made in the perfect or beetle state by means of the ample rose-colored wings, which, when the insect is at rest, are compactly folded up beneath the striped wing-covers. Its spread, however, over the more populous portions of the country, is not to be attributed to its powers of flight alone. It undoubtedly availed itself, to no inconsiderable extent, of every means of transportation afforded to other travelers, and often got a lift on eastern bound trains, and most probably crossed the more barren plains bordering its native confines through man's direct agency, i. e. by being carried. There is a possibility that in some instances it may have been carried in the egg state on living plants, or in the pupa state in lumps of earth; but these modes of transit, if they have occurred at all, have necessarily been exceptional. Even the winds and waters aided its progress. Its invasion of Canada, for instance, took place at precisely the two points where we should expect to first meet with it in the Dominion, namely, near Point Edward, at the extreme south of Lake Huron, and opposite Detroit, near Windsor, at the southwestern corner of Lake St. Clair; for all such beetles as fly into either of the lakes from the Michigan side, would naturally be drifted to these points.

Many insects that are subject to very great multiplication, though not naturally migratory, often acquire the habit of migrating in



swarms from one part of a country to another; and the migrating tendency has at times been quite marked in our *Doryphora* during its eastward march. This tendency is particularly noticeable in the last or Fall brood, and I have seen the beetles in autumn, swarming in the air or traveling in immense armies on foot—all instinctively taking the same direction, which is indeed a peculiarity of all animal migrations. There can be little doubt, therefore, that the larger areas have been traversed by this insect in the latter part of the growing season.

#### AREA INVADED BY IT.

From the foregoing account it is manifest that this pernicious beetle has spread over an area of nearly 1,500,000 square miles, or considerably more than one-third the area of the United States. It has traveled over two-thirds of the continent in a direct eastern line, and at least 1,500 miles of this distance since 1859. It occupies at the present time, more or less completely, the States of Colorado, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Kentucky, Ohio, New York, Pennsylvania, District of Columbia, Virginia and West Virginia, Maryland, Delaware, New Jersey, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire and Maine, in none of which it was autochthonous, except the first mentioned. If we wish to outline the whole territory now occupied by it, we must add to the above, parts of Wyoming and Dakota, where it was native, a large portion of Canada and limited portions of N. Carolina, Tennessee, Arkansas, Indian Territory, Texas and New Mexico. The map given on page 36 (Fig. 12) tells the story better than any words I can employ.

#### CAUSES WHICH LIMIT ITS SPREAD.

There are reasons why the Colorado Potato-beetle did not spread as rapidly along the line of its southern as along that of its northern march. The first is, that the potato is not in such general cultivation along the latter as along the former parallel, and potato fields are, therefore, more scattered; the second, that the insect was northern rather than southern in its native habitat; the third, that it suffers and does not thrive where the thermometer ranges near 100° F. The larvæ frequently perish under such a broiling sun as we sometimes have at St. Louis, and during very hot, dry weather, it frequently fails, as it did in 1868, to successfully go through its transformations in the ground, which becomes so hot and baked that the pupa dries out, and the beetle, if it succeeds in throwing off the pupal skin, fails to make its way to the surface. For these reasons it may never extend its range very far south of the territory now occupied. Its northern spread is not limited by any such cause, and the intensity or length

of the winter will hardly affect it, except in reducing the number of possible annual broods, and consequently its power of multiplication. The state of dormancy once entered into may continue a month or two, more or less, without seriously affecting most insects. We may expect, therefore, to see it push to the northernmost limit of the potato-growing portion of the country—a limit which it has already well nigh reached.

The question whether it will extend farther westward and reach the Pacific, is a more interesting one. There is the best reason for believing that the Rocky Mountains furnish an impassable barrier to it, as they do to so many other insects. It has already been shown (Rep. 7, p. 2) how potatoes in the mountains were for years less affected than were those of the Mississippi Valley; but that in 1874 the insect proved quite injurious to those of the mountain region of Colorado. The fact is well established that it has not reached more than three or four miles into the mountains, or to about the middle elevations—say 8,000 feet above the sea level. The reason is that the atmosphere above that level is so dry and attenuated that, taken in connection with the cool nights, the eggs, or the larvæ that succeed in hatching from them, shrivel and dry up. We have here, therefore, a physical barrier to its further westward progress, and the beetle is no more likely to reach California without man's direct assistance and carriage than it is to cross the Atlantic Ocean without the same means. Whether it could thrive on the Pacific Coast, where the summers are so dry, is another question; but I fear it would hold its own, in many portions, if once introduced. In this connection it will be well to state that geographical races of *Doryphora 10-lineata*, differing in no very important characters from the typical northern specimens, occur in S. Texas, New Mexico, Arizona and Mexico, though they seem to have no more acquired the potato-feeding habit than the *D. juncta* has done.

#### HOW IT HAS AFFECTED THE PRICE OF POTATOES.

During the earlier years of the insect's devastations in the Mississippi Valley, it materially affected the price of potatoes, not only by its direct ravages, but by discouraging farmers from attempting to cultivate the crop on an extensive scale. In 1873 the price reached the high figure of \$2.00 per bushel (wholesale) in the St. Louis market; and many a family had to forego the luxury of a product which a few years before had been one of the cheapest of the farm, and so abundant as to enter largely into the feed of all kinds of stock. At the present time, with the improved methods of fighting the enemy, there is no longer the same dread of it in the Western States that formerly

existed: its management is considered part of potato-culture, and its natural enemies assist man to that degree that its effect on the crop is less felt. The quality of the tuber was very seriously affected through the defoliation which the vines so generally endured, and it was at one time difficult to get a non-watery potato on our western boards.

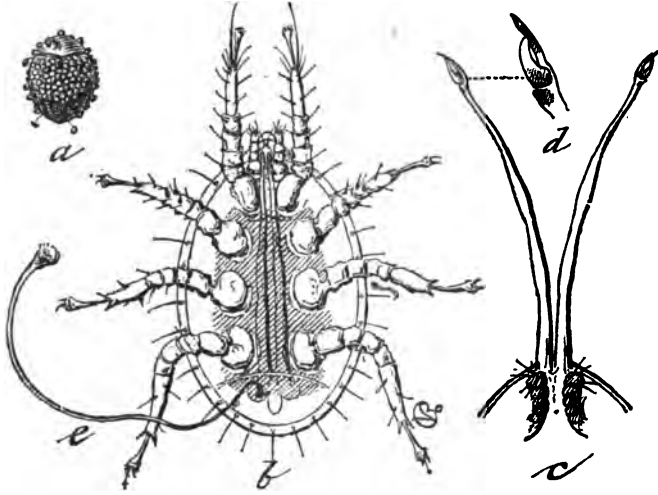
#### THE MODIFICATION IT HAS UNDERGONE.

In previous Reports I have, from year to year, shown how the species, as it spread over the country, became modified in habit, and increased the number of its food-plants. It has also undergone considerable modification in character. Specimens which I have examined from different parts of the country, show great variation in the marks of the thorax, in size, in coloration, and even in the ornamentation of the elytra and legs. The yellow varies from deep gamboge to almost pure white, the black line along the elytral suture is either very distinct or as obsolete as in *juncta*; while some specimens have the pale legs and the femoral spot, more or less distinct, which are so characteristic of this last. In northern Iowa and Wisconsin I have seen millions traveling over the ground, the average size of the individuals being not more than half that of the more typical specimens; and the general ground-color being white rather than yellow. In its southern range the colors tend to brighten and the black to become more metallic. Indeed, the variation which it has already exhibited furnishes interesting material for the close species makers.

#### AN ADDITION TO ITS NATURAL ENEMIES.

Among the many different enemies of this potato depredator that I have treated of, only one true parasite (*Tydeella doryphoræ*) was, up to 1876, described, and that an internal one. In the summer of 1873, Mr. H. C. Beardslee, of Paynesville, Ohio, sent me a mite with which he found *Doryphora* attacked, and last summer this same mite was found by Mr. W. R. Gerard, to very generally infest the beetles around Poughkeepsie, N. Y. It sometimes so thickly crowds and covers its victim that no part of this last is exposed, and the beetle thus infested languishes and eventually perishes. This minute parasite is about the size of the head of a small pin, broadly oval, depressed, the body in one piece, somewhat tough above, and yellowish-brown in color. It is not uncommon on other beetles, and is closely allied to a well known European mite parasite of beetles and other Articulates—the *Uropoda vegetans*. This last is described by authors as possessing the peculiarity of attaching itself to the hard, shelly parts of its victims by means of a thread-like filament that issues from the posterior part of the body. A careful study of our American

[Fig. 13.]



UROPODA AMERICANA:—a, Colorado Potato-beetle attacked by it—nat. size; b, the mite, ventral view, and showing the penetrating organs lying between the legs; c, the organs extended; d the claw; e, the excrementitious filament—all greatly enlarged.

species has convinced me that the similar anal filament, which also helps it to adhere to *Doryphora*, is in reality excrementitious, sticking to the beetle and to the mite by a flattened disc at either end—being quite fragile and easily broken. The true penetrating organs, which enable the mite to hold tenaciously to its victim, and doubtless assist in obtaining nourishment, I have discovered to be a pair of extensile processes, each armed at the tip with a bifid claw, somewhat resembling that of a lobster. When at rest these organs are retracted and lie between the legs and just under the skin. When extended, they are usually brought closely together and extend the whole length of the animal beyond the head. They seem to be thrust forward by a series of muscles at the base, and I have frequently seen one extended while the other remained retracted. Thus, in addition to the more frail excrementitious and adhesive filament, this *Uropoda* is provided with an organ that is beautifully adapted to penetrating the hard covering of beetles, and of thus securing it to its slippery support.\*

\* As will be seen by the figure, these organs in repose extend so far back toward the anus that it is difficult to believe that they compose part of the mouth structure. Yet in carefully studying them I felt convinced that they were maxillæ, or rather the homologues of these organs in hexapods, and, in June, 1876, so informed Dr. A. S. Packard, Jr., to whom I submitted specimens. Through his courtesy I have recently (Jan. 5, 1877,) had the pleasure of perusing an elaborate and admirable article by P. Kramer, of Schleusingen, Prussia, on the natural history of certain genera in the family Gamasidæ, published in the *Archiv fuer Naturgeschichte*, 42d year, Part I, 1876. According to Kramer these hitherto undescribed organs (his *Scheerenaster*) occur in most Gamasid mites, though differing greatly in length and considerably in form in different species. He considers them 3-jointed, the basal joint simply cylindrical, the second likewise so at base, but ending in a strongly chitinated claw, generally toothed inside, and the third forming the inside finger of the claw, also generally toothed. In *Uropoda Americana* no true joints are discernible in the body of the processes, though there are restrictions. These maxillæ are evidently elastic and the anterior portion may be retracted more or less into the basal. Nor should I designate as a joint the thumb-like articulation of the terminal claw. Indeed, these claws seem to me to both of them articulate on the end of the process. In the species under consideration two teeth are sometimes discerned on the small thumb, but ordinarily they are not easily resolved.

## ITS INTRODUCTION TO EUROPE.

While some Europeans have been unduly alarmed, and inclined to take proscriptive measures to prevent the insect's introduction, others have ridiculed the idea that the insect could get to Europe, one of them declaring that there is no more danger of the insect's chance transportation than that of our rattlesnake.

The opinion is also freely expressed by certain good authorities, that the female could not retain her eggs during a whole passage. They forget that the eggs are laid at different times, covering a period of several weeks, and that the hibernating beetles are restless and active, without inclination to lay, for several weeks in Fall and Spring.

The actual occurrence of a living beetle on the Bremen Dock Yards, in a cargo from New York, was extensively reported in the press last Summer, but as the accuracy of the report was subsequently questioned, I took some pains to ascertain the truth. The German Consul at New York, H. A. Schumacher, obtained for me every assurance of the fact; while Prof. Dr. Buchenau, of Bremen, confirms it. The beetle was found alive in unloading a cargo of Indian corn from the steamer "Neckar," and another specimen was found in mid-ocean on the coat of a passenger of the same vessel.

Others, and among them some good entomologists, particularly of the Belgian Entomological Society, continue to express the belief that our *Doryphora* would not thrive if introduced. I have already expressed my belief that "an insect which has spread from the high table lands of the Rocky Mountains across the Mississippi Valley to the Atlantic, and that flourishes alike in the States of Minnesota, Wisconsin, Upper Canada and Maine, and in Maryland, Virginia and Texas—in fact, wherever the potato succeeds—will not likely be discomfited in the potato-growing districts of Europe."—7th Rep., p. 5.

The more serious and weighty reasons against the possibility of acclimatization, have been urged by H. W. Bates, F. L. S., in a memoir published in 1875, in the Journal of the Royal Agricultural Society of England, (Vol. XI, Part II). He argues, firstly, that no American beetle has been acclimated in Europe, though several European species are known to have been in America; secondly, that the group to which *Doryphora* belongs is not represented in Europe, and is remarkably restricted to elevated plateaux in the interior of this continent, and range toward the tropics rather than toward the north; thirdly, that the insect has not passed west of the dividing ridge of the Rocky Mountains, or got foothold on the Pacific Coast, which in climate more nearly resembles Western Europe.

Mr. Bates lays some stress on the fact that few American plants and insects have been acclimated in Europe, citing only the Common Water Weed, (*Anacharis Canadensis*), which has spread through their ponds and canals, and the Grape Phylloxera, which has done so much injury to French vineyards. He also says that no American beetle has become acclimated. While it is true that we have received many more species than we have given, enough more of our insects and plants have established themselves there to weaken the force of the objection. The Horse Weed, (*Erigeron Canadense*), and the Grape Mildew, (*Oidium Tuckeri*), may be added to the plants; our common White Ant, (*Termes flavipes*), has done much damage in some parts of Germany; the Woolly Aphis, or American Blight, (*Eriosoma pyri*), is quite a pest in England and on the Continent; a minute yellow ant, (*Myrmica molesta*), which so annoys our housekeepers, has, according to Fr. Smith, been naturalized, and is very troublesome in England; while at least two of our beetles, viz., the Pea Weevil, (*Bruchus pisi*), and the American Meal Worm, (*Tenebrio obscurus*), have been naturalized in Europe—the former doing some damage in S. France; the latter being quite widespread and now sent back in about equal numbers with the European Meal Worm, (*Tenebrio molitor*), by those who make a business of rearing the worms for bird fanciers.

There is some force in all of his arguments, but Mr. Bates does not sufficiently appreciate the exceptional adaptive and migrating powers which the species has exhibited. There are hundreds of North American insects—and some of the most injurious too—which no one fears will ever reach Europe or establish themselves there, because they are restricted, and have for years been restricted to certain geographical areas. They have exhibited no especial powers of adaptation to new conditions. But our Potato-beetle forms one of those exceptional cases that occasionally confront us. We mark and note the exceptional vitality though we cannot give a reason for it. Why has *Doryphora 10-lineata* overrun the country and become such a pest, while its scarcely distinguishable congener, *Doryphora juncta*, feeding on the same genus of plants, has proved incapable of that adaptation, and remained harmless? Whatever the reason, the fact weakens the force of all generalizations based on geographical distribution. The reasons why the species has not passed west of the Rocky Mountains, find also their best explanation in the facts already mentioned in considering the causes which limit its spread.

The possibility of its importation, in a living condition, on vessels, is now assured by the experience of the year 1876, and I

must think, with the facts before me, that the possibility of its acclimatization is equally great, especially in South Europe. That it would also hold its own in England and Ireland I have not much doubt. It will rather enjoy the more temperate climate; for while it thrives best during comparatively dry seasons, both excessive heat and drouth, as well as excessive wet, are prejudicial to it. Let us hope that it never will become established in Europe, but that a sufficient knowledge of it will be disseminated there to cause the speedy detection and extermination of the few that may, from time to time, be carried over. Let the Europeans not neglect precautionary watchfulness, however, by virtue of the arguments of those who believe that the insect could not stand their climate—lest they some day learn to their sorrow that they have needlessly underrated our *Doryphora*'s toughness of constitution.

It is gratifying to note that some of the governments are not neglecting those precautions. The Commissioners of Customs in Great Britain have issued an order, accompanied by a description and figure of the insect, directing the officers of the Out-Door Department of the Service to especially look for and destroy any beetle answering the description given, which they may find "on board vessels, or on wharves, quays, sheds, or packages landed from vessels," and to encourage other persons to do the same.

The German Government has also issued a fine colored placard, to be posted on ships communicating between the two countries. Surrounding well executed figures of the insect in different stages, occur the following appeal and directions, the whole gotten up very much as recommended in my 6th Report.

#### LOOK OUT FOR THE POTATO-BEETLE!

A warning and request, addressed to all who can assist in preventing the importation of this beetle, and thereby make themselves Benefactors of their Fatherland.

*Published by Order of the Royal Prussian Agricultural Department.*

The drawing herewith presented shows the insect, with eggs and larvæ, which is known in North America as the Potato-beetle, Colorado Potato-beetle, Colorado bug and Potato-bug; and which, of late years, has damaged the potato to such an extent as to render its cultivation, in some parts of America, almost impossible. Therefore the importation of this beetle into Germany should be prevented by all possible means. The Potato-beetle and its larvæ live principally on the leaves of the potato plant; but it has also been known to feed on the different species of night-shade, on the tomato, and even on cabbages.

[Here follows a succinct and very good account of its natural history, and of its spread over the continent.]

The only danger of importation of these insects into Germany lies in the maritime intercourse between the two countries. Swarms of the beetles are carried out to sea by the wind, and it is not improbable that numbers of them might fall onto ships, and so reach, alive, the German sea-ports, it being proved by experiment that they can exist for six weeks without food whatever. It is also possible that they might be brought on ship-board singly through being packed in with vegetables purchased in American sea-ports, such as cabbages or tomatoes, or other merchandise. Larvæ and eggs might be shipped in like manner. [This, as I have already shown, is unlikely.] In

- the earth adhering to the potatoes there is also danger, as with it the pupæ and even the beetles can be imported.

Now, as all remedies hitherto tried against this pest, such as hand-picking or poisoning in the fields, have proved unsatisfactory [It is scarcely necessary to state to the American reader that this is incorrect], the importation of the beetle into this country would be simply the destruction of German potato culture, on which, in a great measure, depends the subsistence of our population.

All captains, crews and passengers on vessels running between America and Germany will, we hope, willingly lend their assistance to the prevention of such a calamity by keeping a sharp look-out for beetles, eggs, larvæ and pupæ; by destroying every specimen found on ship-board; by avoiding all unnecessary trade in vegetables; by using all possible precaution in the matter of clearing ships, etc.—thus materially helping the officers of our sea-ports.

All officers of German sea-ports are requested to inspect keenly all articles of American export whereby the beetle might be unintentionally introduced into Germany. The importation of potatoes from America, and the transferring of potato peelings and kitchen waste from the ships to land, is herewith forbidden.

#### "POTATO PEST POISON."

Several persons wrote last Summer to get my opinion of a purported new remedy for the Colorado Potato-beetle, then being extensively advertised under the above name by the Kearney Chemical Works, 66 Cortland street, New York City. I should, on general principles, dissuade any one from purchasing a secret remedy, when a cheap, simple and effective one is well known. Yet, as there is always room for improvement, and the inventor and discoverer of something valuable has a right to profit by his discovery if he can, I am just as ready to commend as to condemn any insect remedy offered to the public, according as it merits condemnation or approval—desiring to do justice to the rights of the individual as well as of the public. What, then, is this *new* "Pest Poison," and does it represent some valuable discovery which deserves to be kept a trade secret? Or is it simply one of the many secret nostrums constantly offered to the farmer by schemers who desire to fill their own pockets? Let a candid consideration of the matter decide.

The circular of the firm claims that this "pest poison" is manufactured on "strictly scientific principles," and that it is "the only safe, sure and cheap destroyer of potato and tomato bugs, chinch bugs, cut worms, wire worms and army worms, caterpillars, and all insects which prey upon vegetation!" Whenever men are found making the ridiculous claim, for any substance whatever, that it is a universal cure for all noxious insects, it is safe to set them down as ignoramus or charlatans. The habits and modes of life of insects are so varied that what may prove a perfectly satisfactory remedy against one species is often utterly worthless against another; while for successful warfare special tactics are required in almost every case. The circular further unqualifiedly claims on one page that the poison "is not injurious to vegetation," while admitting in a special notice on another page "that, if used too strong or too frequently, it injures



vegetation." The truth is that many tender plants are injured by it even when used as recommended, while even stout leaved evergreens are seriously injured when the strength of the solution is doubled. In the "directions for use" we find brief accounts of various insects, which show on their face that the authors of the circular and agents for the poison know nothing about the insects they speak of, and recommend their poison for species upon which it has never been tried. The directions under the head "Army Worm" may be taken as a sample. The passage, with the exception of the first and last sentences, is taken almost word for word, without credit, from an article of mine (*New York Tribune*, November 16, 1875); and in the sentences excepted, we are told that the army worm belongs to the "order of *noctua*!" (*Noctua* is an old genus of the order *Lepidoptera*), and that for this insect the solution must be made of double strength, whereas, thus made, it will injure most grasses.

The special notice closes with the following paragraph:

Furthermore, lest a prejudice should be founded on the fears of some people that the vines or crops will absorb the poison, we have before us detailed experiments for several years past, showing that not a trace of this poison has ever been found in potatoes or grain which have been watered with this solution in much greater quantities than was necessary to destroy worms or insects, and the opinion, also, of eminent chemists, that once in the ground the poison is completely neutralized.

Here again the circular misleads, and I very much doubt whether there is a particle of truth in the statement as to the years of experience or the opinions of eminent chemists. Such language would hold true of the Paris green mixture, but not of the poison advertised. This, upon analysis, proves to be a mixture of arsenate of sodium and common salt, faintly colored with rosaniline; and as opposed to the opinions of the unnamed "eminent chemists" of the circular, I will quote the opinion of Professor Wm. K. Kedzie, of the Kansas State Agricultural College, who says that "the great objection to the use of these compounds is their extreme solubility in water. They are offered to the plant in perfect condition for absorption into its circulation; and while, in the case of Paris green, the minute proportion dissolved is at once rendered inert by the hydrated oxide of iron in the soil, it is by no means certain that the proportion of the latter is in every case sufficient to accomplish this when the arsenic compound is applied in such large quantity and in complete solution."

Last year, in my eighth Report, I had something to say of a "Potato Pest Poison," manufactured by the Lodi Chemical Works of Lodi, N. J., showing that it did not work as effectually as the Paris green mixture, and that there could be no advantage to the farmer in its employment. It was composed of equal parts of salt and arsenic (arsenate of soda). Experiments which I made last Summer show

that the Kearney pest poison acts very much like its Lodi prototype, the only advantage over which it can claim being the faint coloring. The Lodi Company sold a 1 lb. package for \$1, which was to be dissolved in 120 gallons of water or more. The Kearney Company sell a half pound package for 50 cents, which is to be dissolved in 60 gallons. Of course either company could get any number of testimonials as to the efficiency of their compounds. They herewith have mine. To put forth the false claim of the circular I have noticed, is simple humbug. There are plenty of farmers, who, rather than go to the trouble of making their own mixtures, will send for such poison packages, when they once know what the mixture is, where they would not think of ordering a secret remedy. My advice to the manufacturers would be "do not sail under false colors, or claim more than your mixture deserves: let people know that there is just as much danger, if not more, in its use, as there is in the use of Paris green in the wet method. Do this, and put your article up in more secure packages, so that the poison in deliquescing does not soak and drip through in hot weather as it now does; and I believe you will still do a good business, and deserve *not* to be ranked as charlatans."

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### THE ARMY WORM—*Leucania unipuncta* Haw.

#### FURTHER NOTES AND EXPERIMENTS THEREON.

In the article on this insect in my last Report, certain important and mooted questions as to the mode, place and time of oviposition were settled definitely by observation. I have made further observations and experiments during the past year which are of interest as completing our knowledge of this insect's natural history. They were summed up in a brief paper read before the American Association for the Advancement of Science at its meeting in Buffalo, and what follows is mainly taken therefrom.

The eggs are thrust in between the sheath and stalk of well grown grasses, whether cut or standing; or occasionally in between the natural fold of the green leaf or the unnatural curl at the sides of a withered leaf. On low blue grass, where my first observations were made, they are, as stated last year, almost invariably laid in the fold at the base and junction of the terminal leaf with the stalk. The

moth invariably endeavors to secrete them. They are generally laid in single rows of from five to twenty and upward, and they are accompanied with a white, glistening, viscid fluid, which glues them to each other and to the plant, and, when laid in the fold of a spear, draws the two sides securely over them, leaving but a glistening streak along the more or less perfectly closed edges.

There is one other mooted question in the natural history of the Army Worm which I have, the past Summer, been able to settle, viz. whether the species is single or double-brooded. In the review of the matter in my 8th Report, I came to the conclusion that, in the more northern States at least, or over the larger portion of the country in which it proves injurious, it is but single-brooded; and I am still of the opinion that such is the case. But I have proved that, like so many other species which are single-brooded further north, it is frequently, if not always, double-brooded in the latitude of St. Louis. By carefully feeding the moths reared from my first larvæ with sweetened water, and supplying them with grass in spacious vivaria, I succeeded in obtaining eggs from them. These eggs in due time hatched, and the second brood of worms gave me the moths again early in August. The worms were generally paler than those of the first brood, and being the second generation reared in confinement, they were less healthy. I obtained, in consequence, but five moths, all of them unfortunately females. One of these escaped, three died without showing any development of the ovaries, while the fifth died with the ovaries so well developed that the eggs, in a state of nature, would probably have been laid within a week. This was about two weeks after issuing or about the middle of August, and would indicate that a third generation of worms may exceptionally be produced. Indeed, by diligent search out-doors I found larvæ of different sizes all through the month of August, and a few full grown individuals as late as the 23d of September. Moths were also obtained as late as October 9th from such worms. There is the greatest irregularity about the development of individuals of the same brood and little doubt in my own mind that while the production of a third generation of worms is the exception it may some years prove the rule.

The male moths, reared and fed in confinement, lived on an average 10 days; the females which were impregnated, twice as long, commencing to lay about a fortnight after issuing. What I have previously said as to the longevity of these moths applies therefore to the last or Fall brood only. The worms obtained the latter part of September entered the ground and were found dead upon subsequent examination, but would doubtless have hibernated in chrysalis and confirmed

the conclusions which I have drawn (Rep. 8, p. 45) that the species may hibernate in the chrysalis as well as the moth state.

All the observations I have made are in harmony with the practical conclusion arrived at a year ago, that the eggs of this insect do not, as a rule, if at all, pass the Winter at the foot of grass stalks, as was heretofore surmised. Nevertheless, the burning over of meadows and grain stubble in Winter will act as a preventive of Army Worm injuries, for the reasons that the moth lays very early in Spring, that she prefers the full-grown sheath and stalk, even when dry, to the young green spears, and that she cannot well lay her eggs, for want of support, where the grass is yet sparse and thin, as it is when first starting in a burned meadow. In my last Summer's experiments the females, in secreting their eggs, invariably showed a preference for old hay over fresh and growing grass. Finally, without entering into further details, I give the following as a revised summary of the history of the Army Worm:

#### SUMMARY OF ITS NATURAL HISTORY.

The insect is with us every year. In ordinary seasons, when it is not excessively numerous, it is seldom noticed: 1st, because the moths are low, swift flyers, and nocturnal in habit; 2nd, because the worms, when young, have protective coloring, and, when mature, hide during the day at the base of meadows. In years of great abundance the worms are generally unnoticed during early life, and attract attention only when, from crowding too much on each other, or from having exhausted the food supply in the fields in which they hatched, they are forced, from necessity, to migrate to fresh pastures in great bodies. The earliest attain full growth and commence to travel in armies, to devastate our fields, and to attract attention, about the time that winter wheat is in the milk—this period being two months later in Maine than in Southern Missouri; and they soon afterwards descend into the ground, and thus suddenly disappear, to issue again two or three weeks later as moths. In the latitude of St. Louis the bulk of these moths lay eggs, from which are produced a second generation of worms, which become moths again late in July or early in August. Exceptionally a third generation of worms may be produced from these. Further north there is but one generation annually. The moths hibernate, and oviposit soon after vegetation starts in Spring. The chrysalides may also hibernate, and probably do so to a large extent in the more northern States. The eggs are inserted between the sheath and stalk, or secreted in the folds of a blade; and mature and perennial grasses are preferred for this purpose. The worms

abound in wet springs preceded by one or more very dry years. They are preyed upon by numerous enemies, which so effectually check their increase, whenever they unusually abound, that the second brood, when it occurs, is seldom noticed; and two great Army Worm years have never followed each other, and are not likely to do so. They may be prevented from invading a field by judicious ditching; and the burning over of a field, in Winter or early Spring, effectually prevents their hatching in such field.

### THE WHEAT-HEAD ARMY WORM.—*Leucania albilinea*\* Guen.

There can be no more tangible evidence, in present time, of the truth of evolution, and of the constant modification in habit, and con-

[Fig. 14.]



WHEAT-HEAD ARMY WORM:—  
a, a, larvæ; b eggs—nat. size;  
c, d, egg, top and side view—  
enlarged.

sectaneous modification in structural and colorational characteristics among animals, especially among the lower classes, than the frequent appearance, as destroyers of our crops, of insects that were never reported as injurious before. When entomologists speak of a new insect enemy, they are not to be understood as implying a new creation. In a great majority of instances the species has long before been known to them, and has simply, for one reason and another, become unduly multiplied so as to force itself upon the attention of the common observer. In other cases it is new only to a particular locality to which, from some other region, it has been introduced. Yet in the most restricted and well worked-up localities, speaking either zoologically or botanically, new forms appear, and old forms sometimes disappear, in a manner which can scarcely be explained, except by the extinction of the one and birth of the other through modification. Few naturalists at this day doubt that new forms have thus originated in the past.

\*As will be shown at the close of this article, this insect is quite variable and has received another name. I employ the above name simply because it is appropriate and because the insect fully agrees with Guenée's published description. To say *albilinea* Huebn. carries no such definite idea, and *Harveyi* Grote is, in my opinion, but a variety. There is and always must be doubt as to what *albilinea* Huebn. virtually is, since it is founded mainly on a figure; and where there is such indecision it is, in my judgment, and in that of many others, best to discard Hubner. It is for this reason that I consider Guenée's description original, as applying to the species under consideration, and that his name should not be superseded by any other under which the insect may have been subsequently defined.

They are thus originating at the present, and we may occasionally get a glance at the process by the phenomena just referred to.

In the Summer of 1874, reports were not unfrequent of injury to wheat and timothy heads in Maryland and Pennsylvania by a worm which, by rearing, proved to be *Leucania albilinea* Guen.

In June and July of 1875, complaints were again heard, particularly in the two States mentioned, of a worm that injures the heads of the small grains while in the milk. The *Baltimore American* (see *Weekly N. Y. Tribune*, July 13, 1875,) describes it as hollowing out the soft grains, and leaving nothing but the shell and the chaff, and says that "in some rye fields the heads are almost void of grains, and the ground literally covered with chaff," and that "late sowed rye would not be worth the harvesting were it not for the straw." A correspondent from York, Penn., (July 15, 1875,) describes it as playing sad havoc with the wheat-heads here. Wm. T. Smedley, of Lionville, Chester county, and S. S. Rathvon, of Lancaster, Lancaster county, Penn., sent me specimens in 1875, with accounts of their attacking timothy seed and wheat while yet soft. The complaints were more numerous in 1875 than in 1874, though still confined to the Eastern States.

In 1876 this worm suddenly made its appearance in Kansas, especially in Dickinson, Douglas and Davies counties. The first specimens I received were accompanied by the following letter from Mr. Jno. W. Robson, of Cheever, Dickinson county, and dated June 14, 1876:

I inclose a number of caterpillars which are devastating the wheat fields of this county and causing considerable alarm. It was first noticed about ten days ago on Holland Creek, south of the Smoky Hill River, and along the east line of the county north of the same river. Yesterday I discovered it in our wheat. I live close to the north line of the county. This insect is quite new to me, but I judge it belongs to the order Lepidoptera, and strange to say, though a pretty close observer of insect life, I have not noticed any unusual quantity of moths or butterflies hovering over the wheat. The caterpillars begin their depredations at the base of the ear, and sometimes near the center of the ear. In one field that I examined to-day, the caterpillars were abundant. They were mostly at rest, reclining at full length upon the straw, while only a few were feeding on the ears. Any information will be thankfully received. Farmers calculate that they will lose one-third of their crop.

In addition to the specimens received from Mr. Robson, others were sent to me about the same time from different parts of Dickinson, Douglas and Davies counties in that State. The *Salina* (Kansas) *Herald* refers to the ravages of this same worm in that neighborhood, and the *Kansas Farmer* of June 28, publishes several items which indicate that the pest has created no little excitement. As grain began to ripen in the East, the worm again attracted attention there, and specimens were received from Mr. G. W. Shaw, with an account of their ravages along the old Reading Railroad, in the immediate

vicinity of Philadelphia. The insect is also alluded to in the *Country Gentleman* for July 15, as doing injury in York Co., Penn.

Now the interesting feature about this insect is that its appearance in such destructive numbers and its habit of attacking wheat heads are modern phenomena. None of the early writers on economic entomology in this country refer to anything of the kind, and the first notice that I recollect seeing of this habit in this insect was in the Summer of 1872, when, in the *Tribune*, Mr. R. W. Hudson of Huntington county, Penn., described a worm which seriously injured his and a neighbor's oats fields by destroying the heads, and which was erroneously supposed to be the Army Worm. It is highly improbable that the conspicuous ravages of a worm of this kind could have gone unnoticed and unrecorded, either by farmers or entomologists, if they had occurred; and the fact that the species shows a large degree of variation, warrants the belief that it has been lately modified. Feeding originally on some wild grass; undergoing modification, and first acquiring the peculiar habit here described in York county, Pennsylvania, this wheat-head-feeding race may subsequently have been carried to Kansas either in the chrysalis or moth state, or, what is more likely, in the egg state on grain and grass. This would account for its attracting attention there before it was noticed in the intermediate country. Yet a dark form occurs in the immediate country, because I reared such a dark form, answering to Hübner's figure, in 1870, from larvæ that had transformed in a rye field at Kirkwood, Missouri. The wheat-feeding race may be expected to widen the area of its devastation until it spreads over the larger part of the country, and, like its long and well known congener, the true Army Worm, becomes unusually abundant and injurious, whenever the conditions are favorable to its multiplication. We may also expect an increasing tendency in the species to vary, and give rise to still other varieties and races that will perplex definers and describers.

#### HABITS AND NATURAL HISTORY.:

As I have abundantly proved, by rearing one generation from the other, this insect is double-brooded with us.\* The first moths appear

[Fig. 15.]



MOTH OF WHEAT-HEAD ARMY WORM.

*Harveyi*; for specimens bred by Mr. Lintner, of Albany, New York, in August, have, in both sexes, the intermediate size and the secondaries quite distinctly dusky around exterior border but not basally.

\* It is quite probable, however, that, as with the true Army Worm—which, as we have just seen, is double-brooded with us though evidently single-brooded further north—this, its congener, produces but one brood annually in higher latitudes, the insect hibernating mostly in the perfect state. Indeed, there would seem to be such irregularity in this regard that both peculiarities may occur in the same locality; for of a number of chrysalides collected at Lionville, Pa., in August, by Mr. Smedley, from among the shatterings that fell from the mow when threshing wheat that had been harvested early in July, a few only gave out the moths, and the rest are hibernating. Moreover, it would seem that where one brood only is produced, the moths partake of the intermediate characters between the summer brood, which has the pale secondaries and accords so fully with Guenee's description, and the spring brood with darker secondaries, which accords with Grote's

during May, in the latitude of St. Louis, and the bulk of their larvæ are full-grown about the time wheat is in the milk. These produce moths again during the latter part of July, and, in their turn, these lay eggs which produce a second brood of worms in August. These become chrysalides toward or during September, and hibernate as such in the ground.

The habits of the worm, when full grown, are well set forth in what has been already said, and the peculiarity of feeding upon heads of the small grains is quite marked. It prefers the grain itself to all other parts of the plant, and generally leaves the glumes, or gnaws and lets them drop so as to cover the ground with chaff.

The horny outer parts of the ovipositor of the female have very much the same form, appearance and structure as in the true Army Worm (Rep. 8, Fig. 19), the compressed blade being somewhat less robust and less produced and rounded at the upper end. The eggs are also secreted as in that species, and as one might naturally expect from the unity of habit that generally prevails in the same genus. These eggs are, in fact, thrust, in single, double or treble rows of five to fifty or more in a row, between the sheath and stalk of the grains upon which the worms are destined to feed. They are generally fastened, but very slightly, to the inside of the sheath, and are readily seen upon pulling this aside (Fig. 14, *b*). They are thrust in sidewise, compactly pressed together, and not covered with any glistening or adhesive fluid as in *unipuncta*. Each egg, when examined closely, is found to be very soft and yielding, so that its form is fashioned somewhat by the pressure it receives from its neighbors and from the leaf. Normally, the form is of a compressed sphere, the depth from top to base being about half the transverse diameter. The shell is corrugate rather than granulate, the corrugations assuming upwards of thirty more or less distinct ribs. Pale yellowish and translucent when first laid, it becomes slate-colored before hatching, and the shell is so extremely delicate that every hair of the embryo may be seen through it, and it collapses and is scarcely visible after the young worm has hatched. In its rougher and ribbed surface, compressed form and other characteristics, it differs sufficiently from the egg of *unipuncta* to show that egg structure alone cannot be relied on as of much value in generic diagnoses. The eggs hatch, in Summer temperature, in from three to five days from date of deposition.

The newly hatched larva, as in *unipuncta*, is quite a looper, the prolegs on joints six and seven being still more atrophied, and those on joint eight being short. The body is pale at first, with a black head and shiny spot on top of first and last joints. It soon becomes



green, with a brown head; then striped, with five pale and six darker lines, and after going through five and sometimes six molts, the worm assumes the appearance of Fig. 14, *a, a*. When full grown, the best marked specimens are prettily striped with sulphur-yellow and straw-yellow, and with light and dark brown, as follows: A broad, dark brown line along the back, divided along the middle by a fine white line generally obsolete behind; beneath this broad line, on each side, a straw-yellow line, half as wide; then a light brown one of the same width as the last, and becoming yellow on the lower edge; then a narrower dark brown one, containing the white spiracles; then a sulphur-yellow as wide as the third; then a less distinct light brown subventral one, the venter being pale yellow. The head is large, straw-colored, and with two attenuating brown marks from the top to the lower face.

This worm when newly hatched is, therefore, at once distinguished from *unipuncta* or the true Army Worm, by its black head; later by having superiorly five instead of seven pale lines, and six instead of eight dark ones, and when full grown, by its brighter, more strongly contrasting colors, and paler head.

The habit of feeding on the grain becomes pronounced only after the worms are half grown, and prior to that time they feed on the leaves, and are seldom noticed.

The chrysalis is naturally formed just beneath the surface of the ground, but frequently under weeds and other rubbish. It is of the ordinary mahogany-brown color, terminates in a stout horny point, with a corrugated base, and is at once distinguished from *unipuncta* by the stigmata being raised on a rounded prominence, and by other particulars mentioned in the description at close.

The worms acquire their full growth in from three to four weeks from hatching, those of the second brood developing somewhat more slowly than those of the first. The chrysalis state in the Summer brood lasts from ten to fifteen days. The parent moth (Fig. 15) has the front wings pale, straw-colored, with a white line running along the middle to the outer third, and shaded with brown and purplish-brown as follows: A shade beneath the white line, intensified at each end where it joins the white; another along the posterior border, narrow at apex and broadening to the middle, where it projects along the middle of the wing above the white line, fading away toward base, and a fainter shade along the front or costal edge, intensifying toward apex.

#### NATURAL ENEMIES.

The worm is subject to the attacks of three distinct parasites. One, the very same species of Tachina-fly (*T. anonyma*) which I have

so often bred from other insects; the other a pretty Ichneumon-fly (*Anomalon apicale* Cresson) which may be called the Dark-tipped Anomalon.

Of a lot of over a hundred chrysalides received from Mr. John Davis, Junction City, Kansas, fully forty per cent. were destroyed by this parasite, which undergoes its transformations within the chrysalis shell, spinning but a very thin layer of silk on the inside thereof, and issuing finally by gnawing and pushing off the anterior portion.

It is rather a pretty species, about 0.90 inch long, exclusive of antennæ. The wings are smoky-brown, with deeper brown veins, a golden reflection toward base, and a clearer space at tip of front ones. The face and cheeks are pale yellow, with the top of head and eyes black. The thorax is marked with yellowish-brown and black and the compressed abdomen is reddish-brown, with the truncated end more or less black. The legs are generally pale, with the exception of the thighs and tips of shanks, which are darker.

The third parasite is a genuine Ichneumon (*Ichneumon brevipennis*) originally described by Mr. Cresson from Colorado. It may be popularly called the Short-winged Ichneumon and is characterized by its pale reddish-brown color and short, smoky wings.\*

#### REMEDIES.

It is quite evident from the foregoing history of this destructive worm that the practical means of counteracting its injuries are chiefly preventive. It cannot be successfully fought in the worm state, and the wheat grower who has been troubled with it should direct his attention to the destruction of the chrysalides by late plowing and harrowing and to the capture of the moths in Spring by means of lights and sweetened and poisoned fluids. We can hardly hope that such preventive measures will be very generally adopted, especially as at best they would prove but partially successful; and I confess that the species, from the character of its food and of its life-habits must be, with our present knowledge, placed in the category of insects whose management baffles man, and must be left to the work of their natural enemies.

#### DESCRIPTIVE.

**LEUCANIA ALBILINEA**—*Egg*—0.5 m.m. wide, generally but half as deep, the top and base being quite flattened. Color pale-yellowish, translucent and less iridescent than in *unipuncta*: with rugosities which assume on upward of 80 more or less distinct ribs: becoming slate colored before hatching: shell extremely delicate and generally collapsing after exit of larva.

\*The specimen, which Mr. Cresson has kindly compared with his type, differs therefrom in having the wings relatively longer and in the narrow black bands at basal margin of abdominal joints 2, 3 and 4, being obsolete. It may be distinguished as a variety of *brevipennis* for which I propose the variety name *obsoletus*.

*Larva*.—Newly hatched larva 1.9 m.m. long. Like *unipuncta* quite a looper, the prolegs on joints 6 and 7 very much reduced and useless. Head, cervical shield, and shield, thoracic legs, rings on prolegs, pilliferous spots which are conspicuous and normal in position, and bristles from them—black. General color sordid white, soon becoming green. In the *second stage* the black parts become brown, and the body above shows five pale lines on a ground of six dark ones, (in *unipuncta* there are 7 pale and 8 dark ones) generally indicated in the latter part of the first stage. In the *third stage* the head is gamboge-yellow, and the dark lines are olivaceous and the contrast with the five pale lines and the pale venter more decided. The looping habit is also abandoned. In the *fourth stage* the head is honey-yellow with the mature markings indicated in brown, and the five pale superior lines, especially the mediodorsal and the next to it which is broadest, are relieved more strongly by a deepening of the borders of the dark lines. In the *fifth and sixth stages* the characters of the mature larva are approached by the narrowing of the medio-dorsal pale line, the deepening of the dorsal and fading of the subdorsal dark space; by the separation of the subdorsal pale line into two, and by the deepening of the stigmatal dark line.

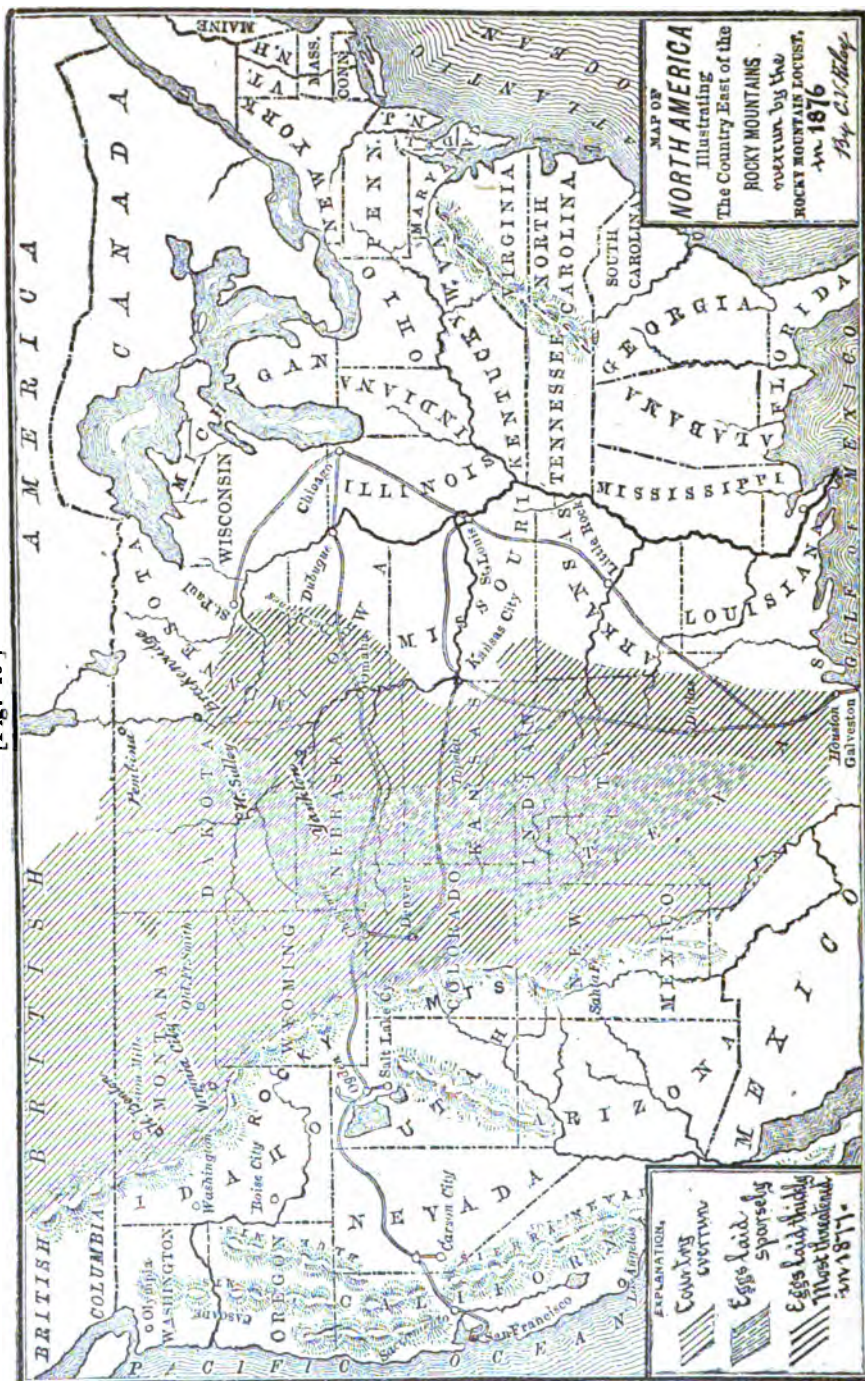
*Mature Larva*.—Average length rather more than an inch. Colors pale yellow and brown. The brighter marked specimens have the dorsum brown with a narrow medio-dorsal yellow line, obsolete posteriorly; then a subdorsal sulphur-yellow line  $\frac{1}{2}$  as wide and suffused in middle with carneous; then a still narrower brown line, ill defined, beneath; then a yellow line of same width as preceding; then a somewhat broader brown-black stigmatal line; then a substigmatal sulphur-yellow line as broad as subdorsal and generally relieved below with pale brown—all the dark parts, except the black stigmatal line, speckled with yellowish. Venter dull white. Head large, wider than body, pale yellow—almost white, with brown tipped jaws, mottlings on the cheeks, and two broad brown marks (with a tendency to fade in the middle) on top, narrowing each side of V-shaped sutures. Stigmata white, with black annulus. (In *unipuncta* they are dark with a pale annulus). Pilliferous spots though more conspicuous than in *unipuncta* in first stage, now less so. Varies considerably, some being quite dark and others greatly suffused with rosaceous; but the pale head, dark stigmatal line and bright yellow lines are constant.

Hundreds of specimens examined. Chrysalis—normal form, and dark mahogany brown. Distinguished at once from *unipuncta* by being more strongly punctate; by the anterior border of the three abdominal joints immediately below the wing-sheaths being but slightly ridged, and deeply, profusely and irregularly punctate all round; (in *unipuncta* these joints have, above only, a clearly defined ridge with a single row of larger and regular punctations) by the stigmata being raised on a rounded prominence; and by the anal joint being much broader and more corrugate at base.

*Imago*.—Average expanse 1.50 inch. Front wings either pale straw, or ochre-yellow with a pale or white line along the median vein, broadening to the disc, and sometimes extending more or less along veins 3 and 4; tapering to base and blending more or less with another pale line which extends a short distance beneath it and fades away posteriorly, each sharply relieved below by a brown-black streak, shaded with brown as follows: a broad pale costal border having a cinereous shade, with the veins, especially towards apex, relieved and pale; a terminal shade with similar cinereous hue, and tapering to apex; a broad shade beneath median white line, with frequently a dark, elliptic streak at its lower border toward base; and generally (not always) connecting more or less distinctly with the terminal shade; and lastly, a cuneliform shade connecting with the terminal from vein 4 to apex, from which it curves abruptly and tapers along the upper border of the median white line, which it helps to relieve. A small discal dot. The tapering shade is generally very clearly relieved by dark streaks at its borders. Fringes white, usually with a dark medial line, and always with a pale inner line relieved by a dark terminal line. Beneath white, with a faint dusky tint opposite the cuneliform shade. *Hind wings*, satiny-white, with frequently a faint dusky shade posteriorly in the ♂. *Head* ochraceous-brown with paler



[Fig. 16.]



palpi. *Thorax* of the same color, paler behind; the collar pale lilaceous, with a white upper border strongly separated from the dark anterior border of tegulæ; three white streaks, one medial and one on each tegula. Anterior legs dusky in front, otherwise, with body, ochraceous. Antennæ simple; having but the faintest fringe of hairs in the male. Eighty-four bred specimens from wheat-feeding larvæ examined.

The above description applies to typical Western specimens of the Summer brood.

As in every case where I have studied large material, the species proves quite variable. The dark marks may have an olivaceous hue, or they may so predominate as to form the ground-color of primaries, with the white medial line well relieved, but the pale shades above and below it reduced to streaks. The discal spot is either obsolete, single, or double, and somewhat reniform; the orbicular spot is sometimes indicated; the tapering dark shade inclining from apex reaches either to disc only, or extends to base of wing; the brown-black streaks may be sub-obsolete; the apical angle varies in acuteness, and the posterior border in obliqueness; the terminal line may be broken into more or less distinct dots; and finally, there may be a series of distinct dots between the veins along the inside of terminal shade, and streaks between the veins, recalling *phragmatidicola*.

Not one of the Summer brood has the hind wings "smoky, blackish" that characterizes *Harveyi* as described by Grote; but two Spring-bred specimens, below average size, accord with his description very well, even to the narrower primaries and scarcely obliquing posterior border. *Harveyi* (and perhaps also Hübner's figure) may, therefore, be considered the Spring form of *albilinea*, just as I have proved by breeding that *Pieris vernalis* is but the Spring form of *P. protodice*. Indeed the tendency to smaller size and deeper color in broods that hibernate in chrysalis is very general.

## THE ROCKY MOUNTAIN LOCUST—*Caloptenus Spretus*, Thomas.

[Ord. ORTHOPTERA; Fam. ACRIDIDÆ.]

This scourge has continued to vitally concern our people and the people of the western country east of the Rocky Mountains. After the fearful ravages which it committed in 1874 and 1875, it will be interesting to take note of its doings in 1876.

It will be remembered, that, in opposition to contrary opinion widely circulated, I expressed my belief, a year ago, that in Missouri, Kansas and Nebraska, first, there would not hatch as many locusts in the spring as would naturally hatch in ordinary seasons from indigenous species; second, that, compared with other parts of the country, those States most ravaged by locusts in the spring and early summer of 1875 would enjoy the greater immunity, during the same season of 1876, not only from locust injuries, but from the injuries of most other noxious insects; that, in short, the people of the ravaged section had reason to be hopeful rather than gloomy; that they certainly would not suffer in any general way from locust injuries in the early season; and that the only way in which they could suffer from the migrating pest was by fresh swarms, later in the year, from the far Northwest.—Rep. 8, 155-6.

Like the other opinions as to the future doings of this insect that I have felt warranted in expressing in an unqualified way, this last was fully justified by subsequent events.

From most of the Western States the crop returns were favorable, though the harvest was in many sections impeded, as it was in 1875, by too much wet weather. In no part of the country was the outlook more flattering than in western Missouri, Kansas, Nebraska, Iowa and the country so seriously ravaged by locusts the previous year, and the farmers throughout that section of country had seldom been freer from insect ravages, or more hopeful. The freedom from other noxious insects was everywhere apparent in our own western counties. In parts of the Northwest, as in the East, the conditions were very different from what they were with us, and the crops suffered more or less from excessive drouth. In Colorado, early in the season, there was some alarm, as the insects hatched in many localities, but by no means so generally as in the previous years. By persevering effort the farmers generally got the mastery over them and have made good crops. In Minnesota, again, in some of the southern counties, where eggs were laid, considerable damage was done, though nothing like as much as in 1875. During the second week of July the locusts took wing from that region, and it is interesting to note that they instinctively took a north and northwest course, just as the fledged insects had done a few weeks earlier in the season from Missouri and the adjacent country to the west the year before. Numerous dispatches to St. Paul, Minneapolis, and other papers, show conclusively that the general direction taken was northwest, and that when the wind was unfavorable the insects awaited a change.

Such was the condition of things up to the early part of August, and I began to hope that the country that had suffered so much of late years by locust devastations, was at last free from the scourge, and would not be overrun again for some years to come. But the great drouth which prevailed in the Northwest appears to have favored the multiplication of the insects in, and their migration from their native haunts, and no sooner had the people begun to congratulate themselves on the good riddance of the pests, than reports came of the movement of new swarms from the north and northwest. From that time on, till the approach of Winter, their movements were reported and they overswept a large part of the Western country.

On the assumption that the hosts that went to make up the invasions of 1873 and 1874 had made an exodus from their native breeding places, and that those, if any, which returned thereto in 1875 were more or less diseased, it was natural to conclude that a few years would be required for the species to again become unduly multiplied there and be constrained to migrate. The intervals that had elapsed in the past between general invasions favored such reasoning. The



fact that the insects had hatched out in immense numbers, in 1875, as high up as British America, from 1874 swarms that had come from the still further north and west,\* was then not known to me; and the experience of 1876 proves how little we know of the native breeding haunts of the species, and that the past history of invasions is no certain guide as to the future.

#### THE INVASION OF 1876.

In order to give a correct idea of the invasion of 1876, I will consider it by States and Territories, and, as far as possible, in chronological order.

**BRITISH AMERICA.**—In Manitoba, as I learn from Prof. Dawson, the insects did not appear in sufficient numbers to attract attention or do any harm to crops, which were very good, nor were any eggs laid there. Far west of Manitoba, however, he has reason to believe that the insect was produced from the egg over a pretty extensive area north of the 49th parallel, and that such was really the case is substantiated by Mr. Chauncy Barbour of the *Weekly Missoulain*, Missoula, M. T., who wrote me July 21st, that travelers in Spring from Ft. McLeod, British America, some 800 or 400 miles northeast of Missoula, reported vast numbers of the young insects there.

**MONTANA.**—The insects hatched extensively in this Territory and no doubt went to largely make up the swarms that subsequently reached over the country to the southeast. The Monthly Report of the Department of Agriculture for May and June mentions them (in its usual inexact way, without dates) as occurring in millions and damaging Spring crops, especially wheat, in Deer Lodge, Lewis, Clarke and Jefferson counties; and the following item is quoted by Prof. Whitman from the *Bismark Tribune* of June 14, 1876:

IN THE FIELD, NEAR ROSEBUD BUTTES, May 29, 1876.

"As we move westward the grazing improves, and here in the Little Missouri Valley the season is at least a month in advance of the season on the Missouri. This would be a splendid grazing region, were the water good. The grass is heavy and nutritious, but the water is strongly impregnated with alkali. Millions of locusts are just now making their appearance in this region. Too young to fly or do much harm, in a few days, should the winds favor them, they will sweep down upon the defenceless agriculturalists on the border, doing untold damage."

The Signal Service reported them as being numerous all over the Territory in June, as flying over Virginia City, southwest, during the middle, southeast during the end of July, southeast in myriads from the 1st to the 5th of August, and as continuing to pass throughout the month until the 29th, when their numbers decreased. No eggs reported.

**WYOMING.**—Reports from Cheyenne show that the insects were abundant throughout the month of August, passing to the southwest, and that swarms were also passing south and southeast on a number of days in September.

**DAKOTA TERRITORY.**—As already indicated, the insects that had hatched in Minnesota, departed during the fore part of July, mostly in a northwest direction. During that time the winds were for the most part strong from the southeast, and the locusts were carried over Southeast Dakota, and were noticed to be particularly thick at Vermillion. From the 10th of the month the wind was mostly from the northwest,

\* See the facts mentioned in discussing the source of the swarms of 1876, further on.



and the insects poured from that direction into the same country that they had previously left. These swarms were doubtless made up of the very insects that had shortly before left Minnesota, reinforced by others that had lived in the Territory; for they were flying at Pembina, mostly south and southeast from the 8th to the 20th of July.

At the Omaha Conference Gov. Pennington stated that the young never hatched in Dakota, founding his statement on the fact, doubtless, that individually he had never seen them around Yankton. I stated at the time that the reports from Signal Service reporters proved the statement incorrect, and the reports for 1876 from various parts of the eastern and southern portions of the Territory show that the young hatched out there early in the season, as they did in parts of Minnesota.\* The Signal Service reports them even far to the north at Pembina, as appearing in June.

From the reports, it is evident that after the first week in July the swarms took a south and southeast direction; further, that until toward the beginning of August they were scattering, did but little damage and laid no eggs—thus indicating that they came from but a short distance. By the first of August, however, and from that on, the swarms were more and more dense, extensive and disastrous, indicating that they had come from a greater distance. It was reported from Yankton, August 2, that the Indians would lose half their crops, but the reports generally during the early part of the month were very contradictory, while those received during the latter part of August showed that the locusts were doing but little damage, and that there had been much exaggeration, especially as to the injury in the Red River Valley. The elevators and warehouses in Yankton were doing a large local business in the Fall. Gov. Pennington represents the damage to wheat at only 5 per cent., and states that corn was one-fourth to one-half a crop. Eggs were laid in the extreme southwest corner, but principally, I think, by the insects from Minnesota. Considerable injury seems to have been done to fruit trees, which in many localities were stripped. Such trees put out fresh leaves and even bloomed again, and it was noted that a frost in September, which stripped most trees of leaves, left the new growth on the locust-stripped trees untouched. I have observed similar results elsewhere.

**MINNESOTA**—Less fortunate than the States to the South, a good supply of eggs was left in the ground in 1875 in some of the more sparsely settled counties to the Southwest, including Murray, Cottonwood, Watonwan, Brown, and parts of the adjoining counties. Many of the farmers were unable to get large amounts of seed-wheat, after three years depletion. The average sown to small grain was, therefore, small. Yet, from statistics furnished me by J. B. Phillips, Commissioner of Statistics, the estimated yield of wheat in the State, notwithstanding all drawbacks, was over 15,000,000 bushels. After the grain was up and the locusts had begun to hatch, it was considered in many cases to be more profitable to seek the certainty of employment elsewhere, than to take the chances of (at best) a small crop at home. But there were quite a number of cases in which men, by using various means, succeeded in saving half or two-thirds of a crop; and reviewing the situation in Blue Earth county, the *Mankato Review* of August 15, says:

It is a notable fact, worthy of mention, in this connection, that the grasshoppers were very bad in the town of Rapidan, but under the vigorous fight instigated by the county and local bonus, the loss was comparatively light—only 8,570 bushels, and the average yield of the town, not including this loss, was about 16 bushels to the acre. The town of Lyra was much less affected by grasshoppers, yet its loss is nearly 2,500 bushels in excess of Rapidan, a sum more than sufficient to pay the local bounty of the latter town.

\* See, more particularly, the records published by Mr. Whitman in his "Report on the Rocky Mountain Locust for 1876."

During the second week of July, these home-bred locusts took wing, and it is interesting to note that they instinctively went in a north and northwest course, just as the fledged insects had done a few weeks earlier in the season, the previous year, from Missouri, and the adjacent country to the west. Numerous dispatches to St. Paul, Minneapolis and other papers, show conclusively that the general direction taken was northwest, and that when the wind was unfavorable, the locusts awaited a change.

The exodus to the northwest was, however, by no means so general as from the more southern country the year before, and, as I learn through Mr. Whitman, many of the insects remained and commenced laying early in July, within two weeks after they had commenced to fly, and not many miles from their hatching grounds. This has never occurred in our own State, and simply indicates what I have in these Reports maintained, viz: that Minnesota is so much nearer the native home of the insect that the species can sustain itself for a longer time there.

The swarms that left early in July returned, did more or less damage, and toward the end of the month left in numbers in a southerly direction. Some, however, remained. About the 6th of August fresh swarms came from Dakota, having been heard of on the 23d of July as passing over Gen. Crook's army. These, as I learn from Mr. John C. Wise of *The Weekly Review*, Mankato, by letter of August 22, pushed continuously to the southeast, and reached as far east as they were ever known to do, or as far as the southwest corner of Dodge county.

*The Pioneer Press and Tribune* of the 19th remarked:

They appear to have left the southwestern counties and moving northward, have settled down on strips of land, to a width of 65 miles, extending from the upper part of Nicollet county to Minnesota Falls; south to a line drawn between these points there are but few hoppers reported, and they are not doing any damage—but they extend northward up to Otter Tail county and beyond.

They were found at intervals over that whole country, depositing eggs, doing much damage in some localities and scarcely any to others. They came too late to do much damage to the principle crops, which were mostly harvested. If we study the reports from the south and southwestern parts of the State, published in the journal aforesaid, we find that from one-half to two-thirds of a crop of the small grains had been harvested on an average in the worst visited section, and drouth and other insects, such as the Hessian-fly had much to do with the poor yield. The eggs were extensively destroyed not only by the Silky Mite, but by the *Anthomyia* Egg-parasite, and the Ichneumon grub, which I shall describe further on. It was further noticeable that the insects came down with the northwest winds, and that when the wind changed to the south, as it did for several subsequent days, few of the insects returned with it. The great bulk of them were restless and remained till the winds shifted again to the north and northeast. Another noticeable feature was that the eggs were quite generally laid in very moist ground, as there was abundant rain about the middle of August. Throughout the month of September the insects were moving mostly south and southeast, spreading, but very gradually, further and further east. Many of them remained and continued laying till frost.

The fact, that in their previous invasions into Minnesota the locusts had never penetrated farther east in Blue Earth and Nicollet counties than the Minnesota river, led there, to the advancement of a theory that they are peculiar to and thrive only in an alkali region. This is the character of the region west of the Blue Earth river, across which they, seemingly, had never ventured to any extent, and certainly had never prospered.

In answer to an inquiry on the subject last August from Mr. Wise, I stated my

belief that there was no ground for the theory, and that I had more faith in the other causes which I have discussed as limiting the eastward spread of the species. Subsequently the insects extended some distance beyond the river in question. Indeed, they reached a full degree further east than in previous known invasions, extending from Clay county to a little west of St. Paul, and thence to Dodge and Mower counties.

Eggs have been laid more or less thickly over the larger part of the southwest half of the State. Mr. Whitman has carefully mapped out the area, and it includes most of the country southwest of an eastwardly bulging line drawn from Clay to Mower counties, or about four times the territory in which eggs were laid in 1873, and about five times that in which they were laid in 1874 or 1875. It is a singular coincidence, however, (and something similar will be noted in Kansas and Missouri further on), that, as reported by Mr. Whitman, those counties in which the insects hatched in Spring, and where vegetation was mostly consumed, are most nearly free from eggs.

Governor Pillsbury has, from the first, taken a lively interest in the suffering of the farmers from this plague, and by a timely proclamation, setting forth the best known means to be used against them, and in other ways, has done much good. He devoted considerable space to the subject in his last message, and urged legislative action, not only on the part of his own State Legislature, but on the part of Congress. As a result of his efforts, and the liberal policy pursued in having investigations officially continued by Prof. Whitman, the people of the State, by means of organization and ingenious machines, are better prepared to meet the enemy next year than are those of any other State. The legislature also has recently passed two bills which are important in this connection; the one appropriating \$75,000 for seed grain to the destitute, the cost of the grain to be assessed against the property of the person receiving it, and paid, as other taxes, in two equal assessments, whenever the recipient shall have raised two crops; the other provides for a bounty of \$1.00 per bushel for all grasshoppers caught previous to June 1 next, with smaller compensation thereafter as the insects approach maturity.—(See further on under "Legislation.")

COLORADO.—What with persistent and generally successful fighting by farmers, with burning machines, ditches and coal oil, together with their natural enemies and the heavy rains, the insects that hatched out in Colorado had greatly diminished in June, and those that took wing vanished without leaving any very strong impression as to the direction taken.

During the early part of August the locusts were passing over large parts of Colorado from the north, in a southwesterly direction, at the rate of about fifteen miles a day. They came in successive and almost continuous clouds, and the general opinion was that they came from Wyoming. The small grain was mostly saved throughout the State, but all late and green crops suffered. The *Colorado Farmer* (Denver) of the 10th of August, stated that, while the damage had been great, it was quite probably over-estimated; and the same journal a week later, reported that the insects had very generally left that part of the State. According to Signal Service reports, they had also very generally left by the 13th, but others were passing over from the 22d to the 28th, and thenceforward in diminishing numbers. Toward the end of the month they were very thick along the Denver and Rio Grande Railroad, frequently impeding the trains.

The *Georgetown Miner* gives the following account of their drowning in large numbers:

\* \* \* As the ravenous millions were driven up against the high ranges about Mount Evans, they were chilled and commenced falling into the little stream which flows past Sisty's place, until for days, the rivulet was transformed from

a sparkling stream of limpid water, into a floating mass of dead grasshoppers, the water becoming so corrupt and offensive that neither man or beast could tolerate it. The trout pond in Mr. Sisty's meadow became so putrid that he was compelled to cut away the dam and let the accumulated filth flow off. Mr. Sisty says that he never before witnessed such a phenomenon. The theory is, that a cold shower along the range threw down the dense swarms of insects, which were drowned, and the little tributary streams swept them into the brook in such numbers that it required days for the whole to be carried away, while the masses that had accumulated in the eddies, decayed, imparting putridity to the waters,

Mr. Stanger, of the *Colorado Farmer*, tells me that the flight of the great clouds that were far up in the air, was invariably southwest over Denver, and he believes that eggs were laid over the whole traversible territory of the State.

IOWA—As in a few of the S. W. counties in Minnesota, so in adjoining parts of N. W. Iowa, and notably in Osceola and Dickinson counties, the young insects hatched out from eggs laid in 1875; but, as Mr. J. M. Jenkins, of La Mars, writes me, they had entirely disappeared by the middle of June, either dying of inanition, being devoured by their various enemies, or moving off to the N. W.

About the first day of August, the northwestern counties of this State were visited by heavy swarms. They appeared to cross the State line from Dakota and Minnesota at almost exactly the same date for Emmett, Dickinson, Osceola, Lyon, Sioux and Plymouth counties, and from here they swept at once out into the counties lying eastward and a little to the south. The direction of flight was a little south of east, and the rate at times eight or more miles an hour. The insects were at times so thick as to darken the sun, and to impede trains. That the invasion was from the northwest may be readily seen by consulting a map in connection with the following data furnished by Prof. Bessey of the Agricultural College:

Lyon county, commencement of harvest.

Sioux county, July 27.

Plymouth county, last week in July.

O'Brien county, July 27 or 28.

Pocahontas county, August 1.

Cherokee county, August 6.

Monona county, August 10.

Audubon county, about the middle of August.

Harrison county, August 18.

Carroll county, August 18.

Sac county, August 23. Apparently in northwestern part of county about a week or ten days before.

Pottowattamie county, August 23.

Hamilton county, August 30.

Boone county, first week in September.

Hancock county, September 8.

Guthrie county, from 1st to 10th of September.

Story county, first noticed about the middle of September, flying over in considerable numbers.

The amount of damage done, as shown by all obtainable data, was not so great as in former years. Some lucky sections in the area traversed by them escaped entirely; though a few counties, and particularly those first visited, suffered very heavily. The loss to Lyon county was three-fourths, to Sioux, one-half, of all crops. In Plymouth county corn was damaged two-thirds. Monona and Harrison report injury to corn from 10 to 20 per cent. In Pottowattamie county their preference for nursery-stock and garden vegetables made their injury to the grain-grower comparatively slight. This

was the case, also, in Sac county, where they were represented as making raids on garden produce, and leaving corn almost an immunity from attack. O'Brien county reports the destruction of all uncut small grain, garden vegetables and most of the corn. In Cherokee potatoes were damaged about 75 per cent., corn 25 to 33 per cent., and Fall wheat considerably; and in Carroll corn was injured 25 per cent., and cabbages and turnips devoured "in toto". These are the worst cases. Hamilton county suffered a small loss in late potatoes, Fall rye and cabbage; in Audubon the damage did not exceed one per cent., and the counties of Boone, Story and Guthrie almost entirely escaped damage.

The most eastern point reached was in the middle of the State, and the line retreats from Story county both north and south.

In all the counties invaded, eggs were deposited, and in most instances quite thickly.

Prof. Bessey republished the remedies and recommendations in my last Report, and issued them in a little bulletin, that was easily and cheaply sent to farmers throughout the State.

NEBRASKA—Those locusts that came into Iowa earlier in August passed southwest into Nebraska, and, in scattering numbers, reached Council Bluffs and Omaha August 17. A dispatch from Omaha the next day summed up with the statement that: "a general review of the situation was very favorable, and there was no apprehension of a failure to harvest the fine and large crop."

From many other reports it would appear that in the northeast counties, from locusts and other causes, not more than half a crop of corn was saved, but that most of the small grain was duly harvested; and Mr. L. W. Chandler, of St. Helena, wrote, toward the end of the month, that notwithstanding the injury to corn, the country thereabouts was in better shape than it had been for five years.

Almost simultaneously with the incursions in the eastern part of the State, there were others from the north overrunning the western part, and from the 5th of August throughout the month, their movements were reported by the Signal Service. The direction was principally south, or southwest early in the month, and mostly southeast toward the end of the month; and here, as in Minnesota, it was everywhere remarked that when the wind was from the south, the insects remained and awaited a change before passing over in the main direction. The following account from a correspondence of the New York *Tribune*, gives some interesting details:

Early in August they reached the western portions of this State, but were partial in their depredations, devouring everything in some localities, doing little damage in others. On the twelfth of the month they made a forward movement, and appeared in the valleys of the Elkhorn, Platte and Republican. Our local papers, acting on the "ostrich" policy, suppressed the facts or misrepresented them, and all were wishing for a favorable wind to carry the pests beyond our borders. But a soft, southerly wind, varied by an occasional thunderstorm from the northwest, prevailed till the 23d, when, by a stiff northwester, the grasshoppers rose and came from their exhausted feeding-grounds upon the east and south portions of the State. They came literally in clouds, looking like the frost-clouds that drift along the horizon on a winter morning. They are devouring "every green thing," including shade trees and even weeds, such as the "Jamestown weed" and wild hemp. The great body of them seemed to pass south, moving in dense masses during the 23d, 24th and 25th, and will probably be heard from in Kansas and Missouri.

Eggs have been laid all over the eastern part of the State, but less extensively in the western counties. Ex-Governor Furnas thinks that there are few in the counties over one hundred miles west of the Missouri river, and, regarding the young insects next Spring, he remarks, in a recent letter, "that while in the West we have room for

millions more people, and are glad to have them come, and with us occupy and utilize the broad fertile acres God has bequeathed to the Far West, those who have not "sand and grit" enough to clean out a crop of young locusts are not the men wanted! I repeat what I said to you at the Convention in Omaha, and am prepared to demonstrate the truth of the assertion: that any thrifty, energetic farmer can exterminate the most extensive stock of locusts, on any one farm known, with less labor and expense than he can get rid of an ordinary crop of weeds."

Prof. A. D. Williams, of Kenesaw, Adams county, writes :

It is safe to say that eggs were laid in every one of our sixty settled counties. Not one has escaped. But the amount of eggs in the western part of the State, where they appeared earliest, is much less than in the eastern portions of the State. There is undoubtedly a gradual increase of eggs, all the way from the western to the eastern line of the State—the river counties suffering much the more severely. The amount deposited there is beyond all estimation, while west of Kearney there is not a very large amount.

Upon the whole, I incline to the opinion that the casualties of the season, the depredations of the birds and the efforts of the homesteaders will so diminish the number of locusts in the Spring, that small grains will be raised in the western part of the State. But I fear that unless Providence is unusually favorable, and the people bestir themselves unusually to fight the locusts, very little, save corn and late crops, will be raised in the river counties.

The actual damage done by the locusts last year, in Nebraska, was fully equal to that done in 1874. But the greater abundance of small grains, and the greater reliance of the people upon stock and a more diversified industry, have saved us from the destitution of that year, and largely disarmed *Caloptenus spretus* of his terrors.

KANSAS.—A review of the invasion in Kansas shows it to have been in the main from the north and northwest. The insects came into the northwest part of the State late in July and early in August and were seen flying about in many directions, but mainly southward, during the whole month. Early in September the swarms thickened, and the wind blowing almost a gale from the west on the 7th and 8th of the month, and strong from the west and northwest for two or three days subsequently, the insects during that time swept down in darkening clouds over the greater portion of the State from the 98th meridian to beyond the 96th. The following extracts from my correspondence indicate the nature of the invasion :

I drop you these lines to let you know that the locusts called on us to-day in force. This morning the wind was blowing from the northwest, and as the day advanced the air was filled with a cloud of locusts as thick as any I ever saw before. Toward evening they came down and are resting to-night. They do not manifest much tendency to eat, but may by to-morrow. [Robert Milliken, Emporia, Lyon county, Sept. 9, 1876.]

I am sorry to say that the locusts are still with us, more plentiful than I ever saw them before. As I wrote you before, they made their first call on the 9th, and more plentifully on the 11th, the wind blowing from the north and northwest most of the time from the 9th to the 14th; they traveled before it, except when it was too cool for them to fly, as was the case on the 12th and partly the 13th, but on the 14th they were so thick that the cloud fairly darkened the sun. The 16th, 17th and to-day the wind has blown from the south and they have not flown to amount to anything. They are pairing almost universally and are commencing to deposit eggs. Not enough eggs are yet left to make any serious trouble in the Spring, but if they stay another week I tremble for our prospects.—[*Ibid*, Sept. 18, 1876.]

The locusts came to the line of the Santa Fé Railroad from Hutchinson as far west as Grenada, about the 25th day of August, 1876, brought by a north by northeast wind. They came in great dark clouds for one day (the 24th) at this place, Sterling, Rice county, Kansas. They mostly passed over here to the south and southwest. A few lit upon us and devoured corn blades, potato leaves and some other toothsome herbage. Little real damage is done as yet to crops. Some of the early wheat is eaten and killed and farmers are generally holding off to sow after the locusts leave. A few returned with south winds, but on the 31st, at 2 P. M., the wind changed to north and

nearly all took wing. But great clouds came fresh from the north and the face of the earth was alive with them. A northeast wind, September 1st, carried the greater part of them with it to some place distant from here. Enough remain to do some damage to vegetation and the south winds bring them back, not in great dark clouds as from the north, but some every day. They seem to float about with the shifting winds, perhaps for food, but when the wind gets north they go in swarms. That shows their tendency to migrate southward. Those that remain are laying eggs.—[H. E. Van Demen, Sterling, Kansas, Sept. 6, 1877.

\* \* \* Such a host of insects I never saw. The ground is completely covered and the branches of the trees are bending down with their weight. In my orchard of nearly twenty acres the trees are covered by myriads. Two hundred Siberian crab-apple trees, next to the house, are completely defoliated, and the grove on the north is one huge moving mass.

Our corn crop is splendid, and I think is so far advanced that it will not be materially injured. Thirty acres of wheat which looked beautiful and green in the morning is eaten up. Six hundred and forty acres, two miles south of me, that was looking fine at the beginning of the week, looks this morning as if fire had passed over it. A large acreage has been sown in this county earlier than usual. I suppose it is all gone.—[Jno. W. Robson, Cheever, Dickinson county, Sept. 8, 1876.

Mr. H. A. Brous, a former pupil of mine, who spent the whole Summer in Western Kansas, in company with Prof. B. F. Mudge, kept a careful record of the movements of the locusts, and has sent me the same. From this record it is interesting to note that the western part of the State was just as free in Spring and early Summer of the *Caloptenus spretus* as was the eastern, and that none but the genuine *femur-rubrum* and different species of *Edipoda*, and of other genera, were noticed. The first specimens of *spretus* were seen in Wallace county August 5th, flying south from 10 A. M. to 4 P. M. From that time forth they were noticed almost daily flying in different directions, but thickest when from the W. and N. They were most numerous on the 12th and 13th, and on the 24th they were again very thick in Gove county—in both instances flying S. S. W. and S. W. During September the direction also varied, but was most often to S. W. The highest and heaviest swarms were, however, to the S. On a number of days two distinct strata or currents were observed. Thus, on September 1, there was an upper current going W. and a lower one going S. W.; on September 2, an upper S. W., a lower N. W.; on September 9, an upper S. W., a lower S. E. E. In October there were few noticed.

The damage done, though serious enough, was less noticeable than in 1874. Vegetables and Fall wheat suffered most; one extensive wheat-grower (Mr. T. C. Henry, of Abilene,) losing 2,500 acres. A great many farmers sowed again, and plowed the soil under, believing that where not sown early enough to come up in the Fall, it is best that it should not come up till Spring, and that an average crop under such conditions can be grown.

They reached east, according to the records I have at hand, to a line drawn a few miles west of Lawrence, including the larger part of Brown, Doniphan and Atchison in the N. E. corner; portions of Jefferson, Douglas, Franklin, Anderson, Allen and Neosho, and most of Labette, Cherokee and Crawford counties in the S. E. Bourbon, Linn and Miami were only partly overrun; Johnson and Wyandotte escaped entirely, and most of Leavenworth was untouched. In nearly all of the more thickly-settled country invaded, eggs were abundantly laid; and the insects remained laying until buried by the first snows. In the western third of the State, where the insects came earlier, few or no eggs were laid. It will be noticed that the very counties which suffered most in 1875 have here escaped, as is the case in Missouri, and as is the case in Minnesota with the counties ravaged in the Spring of 1876.

MISSOURI—The counties ravaged by the young insects in 1875, had splendid crops in 1876, and the scarcity which I had anticipated (Rep. 8, pp. 120, 156,) of most

noxious insects, including the native locusts and the Chinch Bug, was everywhere noticed and commented upon. The incoming of the winged insects in the Fall was anticipated and feared, as soon as it was known that they were overrunning Nebraska and Western Iowa. Feeling the importance of obtaining exact data as to the territory invaded in our own State, and in which eggs were laid, in order to indicate just where injury may be expected, or not, next Spring; I have taken pains to examine, or get reports from, all the western counties. These reports, in condensed form, are herewith submitted; and, summarized, they show that the middle western counties, which suffered most in 1875, (i. e., the portion of the State in which the winged insects reached farthest east in 1874, and laid most eggs) were not overrun in 1876, and will not suffer next Spring. Such are the counties of Platte, Clay, Jackson, Lafayette, Cass, Johnson, Bates, Henry, Pettis and Benton. In these counties the farmers have little or nothing to fear, except as they may receive a few straggling and comparatively harmless bevels of the winged locusts next June and July, from the neighboring country. The counties that were overrun and that will suffer are: 1st, Atchison and Holt, and the western half of Nodaway and Andrew, in the extreme northwest corner. 2d, McDonald, Barry, Jasper, Lawrence, Barton, Dade, Newton, Cedar, Vernon, more particularly in the southwest half; Polk in the northwest third; Hickory in the southwest third; St. Clair in scattering places, and Christian and Greene in the extreme border.

The locusts came into all these counties last Fall, very generally ate off the Fall wheat, and filled the ground with their eggs, in most parts quite thickly. As elsewhere, they continued laying till overtaken by frost.

Bates, according to one correspondent, also received a few of the insects in the western half; while a few stragglers are also reported in Harrison, and even in Gentry, Henry and Cass; but it is evident that in these cases they were not in sufficient numbers to do harm or to cause any forebodings for the Spring. They came into the N. W. corner from the N. and N. W., early in September\* and were to some extent prevented from reaching beyond the points indicated, by south winds.

They entered the S. W. counties from the S. W. nearly a month later, invading Newton and McDonald by September 23, and reaching the middle of Barry by the first of October, and Cedar by the middle of this month. It is quite clear that the eastern limit of the swarms which came from the N. and N. W. was receding westward after they reached N. W. Missouri, and that S. W. Missouri, S. E. Kansas and N. W. Arkansas would have escaped had it not been for W. and S. W. winds that brought back insects which had reached south of these points.

The dates of arrival of the insects are nearly a month later than in 1874, and in this respect the 1876 invasion more nearly resembles that of 1866. It was also less immediately disastrous than that of 1874, and most crops were either garnered or beyond injury, and the principal damage was to the Fall wheat, which, as already stated, was eaten down, and in most cases effectually destroyed, at a time, too, when it was generally too late to do anything more than let the ground lie over to plant in corn in Spring.

Various correspondents note that all the holes made by the female were found to contain no eggs when examined, and they argue therefrom that few or no eggs have been laid. From what I said two years ago (Rep. 7, p. 123), and from the philosophy of the process of egg-laying (given further on), it follows that such reasoning is fallacious,

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\*According to Signal Service Reports some were seen in Nodaway county much earlier.



for all holes left by the female are more or less completely empty, since whenever oviposition has taken place, the hole is filled up.

Locusts, or "grasshoppers," were reported as quite troublesome in Ste. Genevieve and other eastern counties, but they were invariably the common Red-legged species (*femur-rubrum*).

*Andrew Co.*—If you draw a line about five or six miles west of the One Hundred and Two River and Savannah, about due north and south, it will show the extreme eastern boundary of the locust this year in this county. It will show you, at its northern extremity, a strip of about eight miles east of the Nodaway River infested; while at its southern point it will be only about two miles. A great many eggs are there deposited, but not so many as were left two years ago; nor is there so much alarm felt now as then. The locusts arrived late, yet in time to eat up Fall wheat before the frost arrested their progress. Where I live—four miles east of Bolckow—there were no locusts and no eggs, and we do not feel much alarm for next year.

BOLCKOW, MO., Nov. 26, 1876.

R. H. TALBOT.

The locusts visited this county in the Fall, but only the western part. It was late in the Fall when they came. They laid some eggs, but they did no great damage.

WHITESVILLE, MO., Dec. 1, 1876.

J. F. SMITH.

The locusts flew into Andrew county in large numbers. They did not go farther east than the center of the county; but in the northwest and western parts they deposited their eggs in great numbers, and the prospect is that next year the supply will exceed the demand.

FLAG SPRINGS, MO., Dec. 9, 1876.

JOHN K. WHITE.

The grasshoppers were in the northwest part of this county and did some damage to wheat crops. They deposited some eggs. Injury from them in the Fall was small.

ROCHESTER, MO., Dec. 18, 1876.

J. KIMBERTIN.

*Atchison Co.*—The locusts commenced to drop here the first day of September, coming from the north with the first north wind we had for some time, and commenced depositing their eggs on the fourth, staying with us till the wind got in the north again, when many would leave every clear morning, but only to be replaced in the evening by others. Though their numbers have greatly diminished in the last few days, timothy meadows, pastures, gardens and all available places are full of eggs, in many instances from three to five thousand to the square foot; Fall wheat and turnips are eaten off close to the ground, and what timothy is not already destroyed, will surely be in the Spring when the eggs hatch.

ROCKPORT, MO., Sept. 10, 1876.

C. E. TREADWELL.

[Dispatches from various parts of the county show that during the early part of September the insects continually came from the N. W., but poured down in increased numbers on the 11th. By the middle of October the unusually warm weather had about that time caused many of the eggs to hatch.]

The Rocky Mountain Locusts came upon us in September and October. The only damage done by them was to the Fall wheat and rye. They covered the entire county, so far as I could ascertain, depositing their eggs all over it. When they commenced laying, the ground was wet, and they did not appear (as far as my observation extended) to deposit as many eggs as heretofore in their cells—not over half of them having eggs in, and even these being seldom more than half filled. I have heard of some of the eggs hatching out late in the season, but saw nothing of the kind myself. I made examinations some time in the latter part of October, and found what appeared to be the common maggot in the cells, the eggs in the same having the appearance of being spoiled, many being addled or entirely without substance in the shell. There is considerable anxiety among our farmers, as well as in the community generally, as to what they will do the coming season. Much could be done, in my opinion, by concerted action in the early Spring months, in destroying the eggs and the "hoppers" as soon as hatched. If half the time given to grumbling and loafing, in this community, had been spent in active efforts against the "hoppers," in past seasons, and had such efforts been general throughout the grasshopper regions, an immense amount might have been saved to the country.

ROCKPORT, MO., Dec. 8, 1876.

JOHN D. DOPF.

*Barry Co.*—The grasshoppers came into this county about the first of October,

from the west, and extended to the eastern border. As far as they came east they laid eggs. They worked on the wheat-fields.

GOLDEN, Mo., Dec. 3, 1876.

W. F. TUTTLE.

*Barton Co.*—The Rocky Mountain Locust made its appearance in this county about the 25th of September last, coming from the south and southwest. They have destroyed the wheat in the southern and western portions of the county, but have not done so much damage north or east. They laid a great many eggs, some of which hatched out before the cold spell we have lately had.

LAMAR, Mo., Nov. 26, 1876.

A. A. DYE.

I take the earliest opportunity of giving the limited information I am in possession of. The grasshoppers came into the northeast portion of Barton county in small numbers on the 2d of October, from the southwest; and again, in large numbers on the 13th, from the south. They destroyed all the late wheat, but deposited few eggs.

DOYLESPOUT, Mo., Dec. 9, 1876.

J. J. BRYNING.

The grasshoppers did visit our county last Fall. They came from the west, or, perhaps, from the southwest. Came into the western part of the county in destructive numbers about October 20th, arriving at Lamar about two weeks later.

In the southwestern corner of this county the wheat is all, or nearly all, destroyed. In the northwestern corner, early sowed wheat is from one-third to one-half remaining—late sowed wheat is all gone. At Lamar, the destruction is less. In the S. E. corner of the county wheat was much injured. In the N. E. corner wheat was not injured at all. They remained where they first lit down until frozen up in sleet and snow. Large pieces of wheat are less injured than small ones, as the hoppers commenced on the edges and worked toward the center. Farmers could not sow over, as the hoppers remained until cold weather. It is impossible to say how much of the wheat that was eaten off will recover, as the ground froze up and wheat stopped growing as soon as the hoppers died. We *know*, however, that the wheat at the edges is killed, but we cannot tell before growing weather how far in it is killed. I have two large pieces, containing 91 acres, in N. W. corner of county, that I *believe* one-third remains uninjured; while a 13-acre piece, 110 rods long, I *believe* is all gone. I believe that most farmers are preparing to sow oats early in the Spring around the edges of their wheat fields, and it is hoped that this course will destroy the eggs. There were comparatively few eggs deposited.

LAMAR, Mo., Dec. 22, 1876.

WM. H. AVERY.

*Bates Co.*—No part of this county was visited by the locusts this Fall. The southern part of Vernon was; also, all Barton, Jasper, Newton, McDonald and the western parts of most counties immediately east of those named. They deposited their eggs in all parts visited.

MULBERRY, Mo., Dec. 14, 1876.

G. B. HICKMAN.

— [Addie Haynes, of Rockville, and others, report them to some extent in the western half of the county, and some eggs laid as far east as Butler.]

We have not had, so far as my knowledge extends, any Rocky Mountain Locusts the past season in our county. Our people sowed last Fall a larger number of acres of wheat than they had put in for the previous three years, and all the wheat fields, up to the present time, look very promising for a good crop.

HUDSON, Mo., Jan. 3, 1877.

CHAS. J. ROBORDS.

*Benton Co.*—No locusts came into Benton county this Fall.

WARSAW, Mo., Nov. 29, 1876.

JAMES H. LAY.

The locusts did not, to my knowledge, visit this county in the Fall. If they did at all, it was in the northwest part, and very few.

MT. VIEW, Mo., Dec. 16, 1876.

J. H. MAXWELL.

*Buchanan Co.*—No "hoppers" visited any part of this county last Fall, nor do I think they came nearer than twenty miles west of it.

AGENCY, Mo., Nov. 28, 1876.

M. W. FARRIS.

*Cass Co.*—There were no locusts in the county during the year.

AUSTIN, Nov. 30, 1876.

H. L. HEWITT.

There have been no locusts in this county the present year, for which all good citizens are truly grateful.

WM. A. SMITH.

EAST LYNNE, Mo., Dec. 3, 1876.

There were a few scattered grasshoppers in this county during the Fall, but I am not sure they were of the Rocky Mountain species. They did no damage and laid no eggs. In fact, depredating insects were remarkably scarce this Fall, except the Flat-headed Apple-tree Borer, which was more numerous than usual.

RAYMORE, Mo., Dec. 4, 1876.

W. H. BARRON.

A few Rocky Mountain Locusts alighted in the southern border of Cass county, and also in our neighborhood, near Harrisonville; but very few. This was about the end of October and beginning of November. I don't think they laid any eggs in this county; I have seen no signs of them. On the 5th, 6th and 7th of November, I was in the southwestern part of Bates county, and there I saw more of them. I saw that the young wheat was eaten off, and, after hunting a little, I found them huddled in under the blades of the wheat.

Their general course of flying was southeast, and I think it was too late in the season for them to deposit any eggs.

DAVID DEFAKAUGH.

RAYMORE, Mo., Dec. 18, 1876.

*Cedar Co.*—The grasshoppers came to this county in October, and remained until the snow came and destroyed them. They laid eggs all the time they were here, and ate all the wheat in the county.

G. W. MONTGOMERY.

STOCKTON, Mo., Dec. 2, 1876.

The locusts arrived here about the 16th of October, and began at once to bore into the ground and deposit their eggs. They chose the hardest ground they could find, seeming to prefer that which was sandy or gravelly. They continued coming for two weeks, and would average one to every square foot of the whole ground. They devoured about nine-tenths of the wheat in this, the south part of the county. They came from the southwest.

W. SMILEY.

STOCKTON, Mo., Dec. 2, 1876.

Locusts were here in vast numbers, laying eggs and destroying nearly all the wheat.

C. W. JORDAN.

WHITEHARE, Mo., Dec. 9, 1876.

*Caldwell Co.*—No injury from locusts in this county, and no eggs laid.

GOULD FARM, Mo., Dec. 28, 1876.

C. L. GOULD.

*Clay Co.*—No part of our county was visited by locusts the past season.

HARLEM, Mo., Nov. 30, 1876.

J. C. EVANS.

The Rocky Mountain Locusts did not make their appearance in this vicinity at any time during the year 1876. An occasional straggler could be seen during September and October. None but close observers noticed them.

DAN. CARPENTER.

BARRY, Mo., Nov. 30, 1876.

*Dade Co.*—The locusts came the first week in October in sufficient force to destroy about all of our Fall wheat. They laid eggs, which, in dry spots, hatched out, and the young hoppers have been killed by the frost.

R. A. WORKMAN.

GREENFIELD, Mo., Dec. 11, 1876.

*DeKalb Co.*—DeKalb county has not been visited by the Rocky Mountain Locust this year.

G. E. SHULZ.

HAVANA, Mo., Dec. 2, 1876.

*Gentry Co.*—A few scattered grasshoppers were seen passing over the county this Fall, but none stayed. They were flying very high in air, and to the southwest.

MT. PLEASANT, Mo., Dec. 8, 1876.

CHARLES S. WHITESCARVER.

One flight of locusts passed over this county. Wind from the N. W. A few stayed here. No deposit of eggs.

GENTRYVILLE, Mo., Dec. 16, 1876.

HUGH STEVENSON.

There were a few Rocky Mountain Locusts along the western part of the county, but they stayed only a few days, and deposited no eggs. LEVI LONG.  
ISLAND CITY, Mo., Dec. 29, 1876.

Greene Co.—There were no hoppers in Greene county, except in the S. W. corner, where they came too late to do much harm. Some passed over to Christian Co. and did some injury. In Lawrence Co., also, they did considerable mischief. F. F. FINE.  
SPRINGFIELD, Mo., Dec. 23, 1876.

Harrison Co.—Only a few straggling grasshoppers fell into this county the past season; they deposited no eggs. Their nearest approach, in large numbers, was about 40 miles west of us. JOSEPH WHITELEY.  
NEW CASTLE, Mo., Dec. 4, 1876.

There has not been any locusts or grasshoppers in this county this fall. COL. H. FITCH.  
EAGLEVILLE, Mo., Dec. 4, 1876.

There were no locusts in either Harrison or Mercer counties the past year. J. H. BURROWS.  
CAINSVILLE, Mo., Dec. 1, 1876.

Henry Co.—The locusts did not get to our county this year. They reached the counties South and West of us. We have a few, remaining from a year ago, that seem to be acclimated, and they are enough, with our native hoppers, to eat considerable wheat; but the weather is good for their destruction this Fall. T. J. QUICK.  
GAINES, Mo.

A few Rocky Mountain Locusts came to this, the eastern part of Henry Co.; but I have seen none, neither have I heard of any depositing their eggs. J. E. STRINGER.  
LEESVILLE, Mo., Dec. 12, 1876.

Hickory Co.—The locust came into the southwest part of this county in the latter part of September. They did little or no damage, as they came in late, and were but few in number. I do not believe they laid any eggs here. Our native locusts, this Summer, were fewer than I have ever seen them, and I have lived on a farm in Missouri since 1849. W. L. SNIDOW.  
ELKTON, Mo., Dec. 7, 1876.

Not any part of Hickory county was visited by the grasshoppers, nor any part of this (Cass Co.) They have been South of us in Vernon, Cedar, Polk and parts of St. Clair counties, depositing eggs. C. J. HOSTETTER.  
EAST LYNNE, Cass Co., Mo.

Holt Co.—The grasshoppers (*Caloptenus spretus*) commenced their flight over us to-day at 12 o'clock M., going in a southeasterly direction. Wind is blowing from the North, which is very favorable for them in their journey this way. They are not in very great numbers as yet; but are reported as being in immense numbers in the North part of the county. J. W. MAPLE.  
OREGON, Mo., Sept. 8, 1876.

The *spretus* are daily increasing in numbers here, taking all the wheat and rye sown in the county. They are depositing eggs. To-day they are going N. W. Wind South. J. W. MAPLE.  
OREGON, Mo., Sept. 26, 1876.

The pests are still with us, and are now depositing their eggs by the million. Some report that a small white worm is killing them, but I have been unable to find any up to this time. Some of the eggs are now hatching in North parts of the county. J. W. MAPLE.  
OREGON, Mo., Oct. 12, 1876.

Many of the grasshopper eggs have been destroyed by a small white worm, and many have been washed out and destroyed by exposure to the weather. The grasshopper limits extend about 5 miles east of the Nodaway River, in Andrew Co. J. W. MAPLE.  
OREGON, Mo., Dec. 2, 1876.

The locusts have spread all over this county, and have deposited their eggs in vast quantities, though perhaps less than in '74. I examined many of their perforations, and in some localities found at least three-fourths empty; in the others, from 12 to 20 eggs. A few passed over here the 25th of August, and occasionally thereafter, until the 20th September, when they came in large numbers. They had destroyed, by the 25th of September nearly all the wheat and rye in the county. On the 26th they were first noticed laying eggs here. A few were noticed on the 11th of November, some on the ground, others flying North. Many farmers have resown their devastated fields, and will no doubt profit by so doing. Some say that worms and bugs have been destroying the eggs, also that the eggs have been hatching out in exposed places. The experience of some of our farmers is against turning the eggs under in the Fall or Spring.

OREGON, Mo., Nov. 29, 1876.

WM. KAUCHER.

The grasshoppers were all over this county, and laid more eggs than they did two years ago, the ground being literally filled with them.

BIGELOW, Mo., Dec. 2, 1876.

J. H. CROW.

From examination made in various parts of the county by several farmers and others, the eggs of the locusts seem to be rotted. This is ascribed to the wet weather, we had some few weeks ago.

CLARKE IRVINE.

OREGON, Mo., Dec. 3, 1876.

The Rocky Mountain locusts came here last Fall in September; they came from the North, and deposited their eggs in great quantities; some stayed till cold weather killed them, and some went on South. Some say their eggs have turned to worms and will not hatch, which might be the case, for I noticed, myself, some worms in the cells, but whether they were deposited by the hoppers, or not, I am unable to say.

FORREST CITY, Mo., Dec. 18, 1876.

J. D. WHITE.

The locusts extended all over our county. They came from the N. W. about September 20th. The ground is fuller of eggs than ever before. All the wheat was taken up; rye also. A few resowed, but it makes no show. They stayed here until frozen to death.

BENNET KING.

OREGON, Mo., Dec. 25, 1876.

*Jasper Co.*—The grasshoppers or locusts came here October 2d, and again on the 3d, 5th, 8th and 9th. Ten years ago they reached three miles east of here; now, they are several miles still further east. No doubt in a week the wheat will be all destroyed, as, indeed, most of it is already. They came from the southwest. Wind south. They did no damage here in the Springs of 1867 and 1875.

THOS. McNALLIE.

SARCOXIE, Mo., Oct. 14, 1876.

The grasshoppers made their appearance in this county again on the 2d of October. The wind was blowing from the southwest during the day. About noon they came into the city; the sky was darkened with them. They soon covered the entire county, and at once began their onslaught upon the wheat fields. Jasper county farmers had put in more wheat than they had ever done before; the season being favorable, it was making rapid growth, and the future looked encouraging with promises of a large wheat crop. In a few days, scarcely a spear of wheat was to be seen over the entire county. However, at the close of November they began to leave; and large quantities of them were found dead; many seeming to have been destroyed by an insect. They deposited eggs, some of which hatched out during the warm days in November. In some of the late sown fields the wheat seems to be starting again; and some farmers have resown portions of their fields, in the hope that a favorable Winter will secure a crop. The eastern line seems to have extended to the west of Green county.

JOSIAH TILDEN.

CARTHAGE, Mo., Nov. 20, 1876.

On the 2d of October the grasshoppers made their first appearance here, coming from southwest and going northeast, in such numbers as to, in a measure, obscure the sun's rays. They stayed here in millions, until killed by cold; eating up all growing wheat and green grass. The ground was perforated in all directions with innumerable holes, and I suppose they deposited eggs in great abundance. We are in the eastern part of the county, a few miles from the Lawrence county line.

REEDS, Mo., Dec. 8, 1876.

J. M. THORNBURG.

Myriads of grasshoppers were passing over Granby, from southwest to northeast.

on Sunday and Monday, the 8th and 9th. A glance upward towards the sun revealed them filling the air as far as vision could extend, as thick as snowflakes in a storm, and they drifted along with the breeze, and fluttered down at your feet occasionally, or lit on your nose, with as much unconcern as if they had been a part of the elements. The bushes and sides of the road were speedily thick with them.—*St. Louis Republican*, Oct. 1, 1876.

The locusts were all over the county in great numbers. They laid a great many eggs, but as most of them hatched out this Fall, I apprehend no trouble next Spring. They came in September, and stayed until killed by frost. No wheat recovered, as far as I know. Farmers generally resowed, but the wheat has not come up.

SMITHFIELD, Mo., Dec. 26, 1876.

WM. G. L. CRIAG.

The wheat that was eaten off did not recover. Very few farmers have resown. There will be no wheat crop in this and adjoining counties this year. Next Fall there will not be much sown on account of scarcity of seed, and dread of the hopper. Some farmers are contemplating a crop of oats on their wheat ground; others, flax and barley.

J. M. PETERSON.

January 2, 1877.

*Jackson Co.*—There were no Rocky Mountain locusts in this county the past Fall, and, per consequence, no eggs deposited. Chinch bugs were seen in the early Fall.

HICKMAN MILLS, Mo., Dec. 4, 1876.

W. S. PARRISH.

The grasshoppers did not deposit any eggs here; only a few straggling ones, and they perhaps of native species made their appearance.

JACOB GREGG.

STONY POINT, Mo., Dec. 10, 1876.

*Johnson Co.*—The Rocky Mountain locust failed to visit us the past season. A few were noticed very high in the air, passing over with the wind, but none alighted. We have no chinch bugs at all this season, owing, perhaps, to the fact that the small grain was totally destroyed by the hoppers in 1875. But such other pests as usually trouble us were very numerous and destructive.

D. B. REAVIS.

KINGSVILLE, Mo., Dec. 4, 1876.

No grasshoppers came here this season. They appeared in Barton county in October, though not in great numbers, and west of that county, in Kansas, for a hundred miles, they were very numerous, and depositing their eggs, at the end of September.

W. A. CAMPBELL.

HOLDEN, Mo., Nov. 27, 1876.

There were no grasshoppers in our county this Fall. There may have been some at the southwest corner of the county, but I do not think so.

WARRENSBURG, Mo., Dec. 8, 1876.

J. L. CLELAND.

FAYETTEVILLE—None.

J. L. MOTSINGER.

*Lafayette Co.*—Lafayette county has not been visited this year by the Rocky Mountain locust.

J. BELT.

LEXINGTON, Mo.

No locusts came into this county the past season, or into Jackson county either.

SNI-~~A~~-BAR, Mo., 1876.

J. T. FERGUSON.

*Lafayette Co.*—There were a few of the genuine Rocky Mountain locusts with us during the latter part of September, and beginning of October; but they were so few in number as to pass almost unnoticed, and were supposed to be stragglers, from a flight that passed down through Kansas, depositing a vast number of eggs as far South as Montgomery county, in that State. If those that were in this county laid any eggs, they were so few as not to be observed, and it is my opinion that none were deposited. As to what part of the county was invaded, it would be hard to tell, as they were so few in number; and the fact that they mix up with the natives, adds to the difficulty.

AULLSVILLE, Mo., December 10, 1876.

JAS. E. GLADISH.

*Lawrence Co.*—The locusts came into this county about the 5th of October. Their course was North. A small portion of the southeast part of the county was not visited by them, and there the wheat crops are not hurt; but they spread over all other parts,

eating up thousands of acres of wheat. Some farmers have resown, but many have not. They deposited their eggs by the acre, choosing, strange to say, the hardest and most gravelly places to lay them in. I found, on examination, just at the setting in of Winter, that very many of the eggs had so far advanced as to resemble small white maggots. The hoppers have penetrated considerably farther East this year in this county than they have ever done before.

W. S. GOODMAN.

MT. VERNON, Mo., December 12, 1876.

*McDonald Co.*—The Rocky Mountain locust visited all parts of McDonald county, and deposited their eggs very liberally, some of which hatched out before the cold set in.

W. D. POLSON.

*Newton Co.*—First saw the grasshopper here on September 29. On Sunday the sky was full of them, going East. From here to Joplin they are everywhere: to-day the ground is covered, and the air filled with them. They are at Granby. Farmers are afraid to sow wheat.

G. C. BROADHEAD.

NEOSHO, Mo., October 7, 1876.

Grasshoppers came into the west part of this county in large numbers on the 23d of September, and soon extended all over it. They came from Northwest at first, but soon they came from all parts, as the wind blew. They would rise and fly off in the fore part of the day, and a new lot would come in at night. They continued very numerous till the sleet storm in November, which killed them; and they filled the ground with eggs; some of which hatched out, and some were destroyed, but plenty yet remain.

JOHN THRASHER.

NEOSHO, Mo., December 7, 1876.

The locusts came into all parts of this county in vast swarms, and laid large quantities of eggs; every batch of land that was bare, and not too hard, is filled with them, and some few have hatched out this Fall.

W. H. WETHERELL.

SENECA, Mo., December 6, 1876.

*Nodaway Co.*—The Grasshoppers came into this county from the Northwest on 11th of September, and left, going southwest, on the 26th of October. They spread over about two-thirds of the county, but the northeast they did not reach, and that part remained uninjured. They deposited eggs, but not so many as was expected from their numbers. Many fields of wheat in the western part of the county were entirely destroyed. The greatest damage was done to fall grain and meadows.

PICKERING, Mo.

M. B. W. HARMAN.

The locust came into the west or northwest portion of our county late in the Fall. In the extreme West they laid eggs, and devoured the Fall wheat.

LUTESTON, Mo., December 14, 1876.

WM. H. CLARK.

The grasshoppers were in the northern and western portions of this county last Fall, but did little damage. They laid eggs, but opinions differ as to the probability of their hatching out next Spring. Many contend that some kind of insect has destroyed them, as, repeatedly, when the holes in which they were deposited were dug into, no eggs were found.

T. D. WALLACE.

HOPKINS, Mo., December 8, 1876.

*Pettis Co.*—A few grasshoppers came into this county last Fall, but I do not think they laid any eggs. They did no damage.

J. K. P. IDOL, M. D.

HOUSTONIA, Mo., November 30, 1876.

The Rocky Mountain Locust did not visit any part of Pettis county during the year 1876.

O. A. CRANDALL.

SEDALIA, Mo., December 11, 1876.

*Platte Co.*—No locusts here this year. Sixty miles north and west is as near as they came to us.

JAMES ADKINS.

PLATTE CITY, Mo., Dec. 1, 1876.

No locusts in our county this Fall; a few are reported to have fallen from a great height, carried out of their course by adverse winds. R. P. C. WILSON.  
 PLATTE CITY, Mo., December 1, 1876.

Polk Co.—The locusts came into our county last Fall at a late date. They did not get so far East as this in large quantities; but at the western border of the county they were numerous, though I have been unable to ascertain whether or not they deposited any eggs; but they came so late that I hardly think they did. T. W. WILSON.  
 PAYNE'S PRAIRIE, Mo., December 18, 1876.

In the three western townships of this county the hoppers have damaged the wheat badly, and have deposited large numbers of eggs. They have been very destructive in the eastern part of Dade and Cedar county. J. CARSON.  
 BOLIVAR, Mo., December 15, 1876.

No wheat was eaten off in this immediate vicinity. I do not think any attempt was made to resow; the damage was done too late. I hear of no measures being taken to protect wheat or other grain from the threatened ravages. T. W. SIMPSON.  
 PAYNE'S PRAIRIE, Mo., December 30, 1876.

The locusts visited the western portion of this county some time last Fall, in October or November, I believe, and did considerable damage to a few fields of young wheat; though I think they were found only in a few isolated spots. Don't know whether they laid eggs or not. H. CARR PRITCHETT.  
 MORRISVILLE, Mo., January 6, 1877.

The locusts visited the western townships of our county, Jackson, Madison, and Johnson. They made their appearance between the 1st and 10th of October, and came from the West. They filled the ground with eggs. Where most numerous they entirely destroyed the growing wheat. J. M. LOAFMAN, M. D.  
 MORRISVILLE, Mo., December 27, 1876.

Ray Co.—No part of our county was visited by the Rocky Mountain locusts during the year. W. R. MEADOR.  
 HARDIN, Mo., December 29, 1876.

St. Clair Co.—The locusts dropped in here in very small numbers late in October. The wind was from the north as they were coming in, and carried the greater part to Texas; only those that had tired out staying with us. They laid eggs, and injured the wheat somewhat. I hear that they have eaten all the wheat from Sac River south to Arkansas. It is very cold just now, and no hoppers visible. Wm. H. FILLERY.  
 COLLINS, Mo., Dec. 2, 1876.

But very few Rocky Mountain Locusts came into the county this year. None to do any damage to crops. South of us, in Barton, part of Cedar and Polk counties, they are reported to have destroyed the wheat crops in places. JOHN HILL.  
 TABORVILLE, Mo., Dec. 6, 1876.

Vernon Co.—The locusts visited the southwestern portion of our county this Fall, doing much damage to wheat. They deposited a vast number of eggs, yet the deposits were not so numerous in proportion to the number of insects as in former years—say fifty per cent. M. L. MODREL.  
 LITTLE OSAGE, Mo., Dec. 9, 1876.

They came into the south and west half of Vernon in great numbers, and, it is said, deposited eggs as usual. Very few appeared in the northeast part, and no eggs deposited there. J. A. PURINTON.  
 SCHELL CITY, Mo., Dec. 2, 1876.

No damage sustained in northeast part of this county. But few made their appearance. In the Spring of 1875, the young appeared in immense numbers, but unaccountably disappeared from this locality before half grown, and did no damage. J. A. PURINTON.  
 SCHELL CITY, Mo., Dec. 23, 1876.



The grasshoppers destroyed every field of wheat with which they came in contact, beyond recovery. On account of the lateness of the season farmers are letting their wheat lands lay over for corn, in the Spring.

M. L. MODREL.

LITTLE OSAGE, Mo., Jan. 8, 1877.

**INDIAN TERRITORY.**—They were thick over most of the Territory, passing southward, from the middle of September, and many of them remaining through the season. They rendered horse-back travel extremely unpleasant.

**TEXAS.**—The swarms reached Texas from the North and West about the middle of September, and from that time forth till Winter were flying very generally, over the State, reaching eventually latitude 29°, or more definitely to the Gulf all the way from the Sabine river to Austin. Their course was almost due South, and their injury confined to succulent vegetables, shrubs and fruit trees, the Orange and Cotton suffering more particularly.

Mrs. H. S. King, of Austin, writes:

The cars for about ten days were so much obstructed on the Texas Central line as to necessitate their stopping occasionally to clear the track of the grasshoppers. Though there were millions, they were never sufficiently numerous to obscure the sun, even for an instant, and they have been, as they usually are at this season, comparatively harmless to vegetation. For about six weeks they would fly up in the promonaders' face like a pelting rain, alighting on the head and clothes, or taking short flights in advance of him.

They were especially thick on walls, fencetops, and tree trunks, remaining there torpid until the sun shone out, and during the heat of the day swarming high in air, when they look like snow-flakes, wafted by changing breezes.

Messrs. Nelson and Sadler, of Galveston, state that the insects occurred all along the line of the Texas Central Railroad. It was most noticeable, as Mr. Jno. M. Crockett, of Dallas, assures me, that notwithstanding the wind was, on the 19th September, and for a few days thereafter, when the heaviest flights occurred, from N., N. E.; it yet varied much during the invasion, blowing mainly from the S. E. Nevertheless the insects made steady progress southward, succeeding best on calm days and not diverging E. five miles in fifty. Contrary winds simply baffled them and brought them to the ground until the conditions permitted them to continue their course.

Eggs were laid throughout the territory overrun, and the young hatched in large quantities during the mild weather of February. Up to the time this writing goes into the printer's hands, (March 5, 1877), the young, which have numerously hatched near the Gulf, have been destroyed by heavy cold rains that occurred the latter part of February.

**ARKANSAS.**—The insects overran the extreme N. W. corner of this State, as indicated in my map, and were particularly bad in Benton county. Indeed the injury was mostly confined to this county and the region south of it, the insects not extending east to Carroll county. This is the first recorded instance of their reaching into Arkansas. They made their advent from the 7th to the 15th of October, coming with the wind from the N. W. and flying S. and S. E., until they struck the base of Boston Mountain. As in our own S. W. counties, wheat was greatly injured by them, and eggs were laid up to the time Winter set in.

From the foregoing record, summed up from numerous reports and observations, it is manifest that the locusts that hatched and did more or less damage in Minnesota early in the year, endeavored to get away to the northwest as soon as they got wings. They were subsequently repulsed and borne back again by the winds to their hatching places; thence south and southwest into Iowa and Nebraska. As

they rise and fly from day to day they concentrate and condense, since in passing over a given area during the hotter parts of the day new accessions are constantly being made to the flying hosts which, with serried ranks, descend in the afternoon. Thus, in returning, the swarms were thicker and more destructive in places than they were in leaving. Yet it is evident that the column which thus came back to Minnesota and passed to the south and southwest was more straggling than in 1874, and that by the middle of the month it had spent its force and left eggs throughout most of the country traversed. Had the invasion consisted of these only, the damage would have been but slight, and the insects would hardly have reached into Kansas. Their eggs, laid in August, were far more liable to injury and to premature hatching than those laid later. But it is clear that fresh swarms that hatched in Dakota, and further northwest, followed on the heels of the Minnesota swarms, passing over much of the same country to the east and southward into Colorado, and eventually overrunning the larger part of Nebraska and Kansas, the Western half of Iowa and some of the Western counties in Missouri, and reaching into Indian Territory, Texas and parts of Arkansas.

The extent of the region invaded will appear by referring to the map (Fig. 16). Coming generally later than in 1874, they did less damage, and the farmers were in so much better condition to withstand injury, that it was much less felt. In most sections visited, part of the migrating hosts remained to lay eggs; and the invasion of 1876 is remarkable as compared to that of 1874, for the large extent of country supplied with eggs. Another fact is notable, viz: that the very parts of Minnesota in which eggs were laid in 1875, and the portions of Missouri and Kansas in which they were most thickly laid in 1874, escaped in 1876. I cannot believe, however, that this is anything more than coincidence.

#### DESTINATION OF THE DEPARTING SWARMS OF 1875.

In considering this subject a year ago, I expressed the belief—founded on observation and the records as far as made—that the swarms which left the country south of the 44th parallel and the 100th meridian passed to the N. W., reaching into N. W. Dakota, Wyoming and Montana. I was unable at the time to state whether or not they reached up into British America, and from the large percentage of the departing insects that were diseased and that dropped on the way, I was led to the following conclusions:

We may very justly conclude that a large proportion of the insects which departed from the country invaded in 1874, perished on their way toward the native habitat of the species, and that those which did not perish reached the Rocky Mountain region of the Northwest whence their parents had come the previous year. They struggled back

with thinned and weakened ranks, and it will probably take many years ere they become so prodigiously multiplied again, and are enabled by favorable conditions to push so far east as they did in the year 1874. They did some harm at their resting places on the way, but in a large number of instances they rose after their brief halts, without doing serious injury. Nor can I learn of any instances where these swarms that left our territory deposited eggs. Had the winds been adverse to their northwestern course, and obliged them to remain in the country where they hatched, I believe that the bulk, if not all of them, would, nevertheless, have perished before laying eggs.—[Rep. 8, p. 108.]

Information gathered during the past year shows conclusively that the insects which left the Mississippi Valley in 1875 did reach into British America. The *Winnepeg Standard* of August 19, 1876, as quoted by Professor Whitman, says :

The locusts which hatched in Missouri, Kansas and Nebraska, in an area of 250 miles from east to west, and 300 miles from north to south, took flight in June, and invariably went northwest, and fell in innumerable swarms upon the regions of British America, adjoining Forts Pelly, Carlton and Ellice, covering an area as large as that they vacated on the Missouri River. They were reinforced by the retiring column from Manitoba, and it seemed to be hoping against hope that the new swarms of 1876 would not again descend upon the settlements in the Red River valley. Intelligence was received here that the insects took flight from the vicinity of Fort Pelly on the 10th of July, and then followed a fortnight of intense suspense.

Professor G. M. Dawson, of Montreal, writes: "You may be interested in knowing that the northward flying swarms in 1875 penetrated a considerable distance into the region west of Manitoba, while most of the insects hatching in the latter Province went southeastward when winged, and that large numbers got at least as far east as the Lake of the Woods." In an interesting paper in the *Canadian Naturalist*, on the "Appearance and Migrations of the locusts in Manitoba and the N. W. Territories in the Summer of 1875," Professor Dawson further gives many other valuable records, some of which, as bearing on the question under consideration, I quote entire, as they will hardly bear condensing :

From the reports now received from Manitoba and various portions of the Northwest Territory, and published in abstract with these notes, it would appear that during the Summer of 1875 two distinct elements were concerned in the locust manifestation. First, the insects hatching in the province of Manitoba and surrounding regions, from eggs left by the western and northwestern invading swarms of the previous autumn ; second, a distinct foreign host, moving, for the most part, from south to north. The locusts are known to have hatched in great numbers over almost the entire area of Manitoba, and westward at least as far as Fort Ellice on the Assiniboine river (long. 101° 20'), and may probably have been produced, at least sporadically, in other portions of the central regions of the plains ; though in the Summer of 1874, this district was nearly emptied to recruit the swarms devastating Manitoba and the Western States, and there appears to have been little if any influx to supply their place. Still further west, on the plains along the base of the Rocky Mountains, from the 49th parallel to the Red Deer river, locusts are known to have hatched in considerable numbers—but of these more anon.

Hatching began in Manitoba and adjacent regions in favorable localities as early as May 7th, but does not seem to have become general till about the 15th of the month, and to have continued during the latter part of May and till the 15th of June. \* \* \*

The destruction of crops by the growing insects, in all the settled regions was very great, and in many districts well nigh complete. The exodus of these broods began in the early part of July, but appears to have been most general during the middle and latter part of that month, and first of August. The direction taken on departure was, with very little exception, southeast or south. It is to be remarked, that as there does

not seem to have been during this period any remarkable persistency of northwest or northerly winds, the insects must have selected those favoring their intended direction of migration, an instinct which has very generally been observed elsewhere.

\* \* \* \* \*  
 Foreign swarms from the south crossed the 49th parallel with a wide front stretching from the 98th to the 108th meridian, and are quite distinguishable from those produced in the country, from the fact that many of them arrived before the latter were mature. These flights constituted the extreme northern part of the army returning northward and northwestward from the States ravaged in the autumn of 1874. They appeared at Fort Ellice on the 18th of June, and at Qu'Appelle Fort on the 17th of the same month, favored much no doubt by the steady south and southeast winds, which, according to the meteorological register at Winnipeg, prevailed on the 12th of June and for about a week thereafter. After their first appearance, however, their subsequent progress seems to have been comparatively slow, and their advancing border very irregular in outline. They are said to have reached Swan Lake House—the most northern point to which they are known to have attained—about July 10; while Fort Pelly, further west, and nearly a degree further south, was reached July 20th, and about seven days were occupied in the journey from there to Swan River Barracks, a distance of only ten miles.

We thus learn that vast swarms not only reached into British America in 1875, from our own country, but that the young hatched there from swarms that had come the previous year from the further northwest.

There was, therefore, north of the 49th parallel, a repetition of the devastation we were at the time experiencing; the insects hatching there in bulk just about the time they were leaving Texas on the wing.

#### SOURCE OF THE SWARMS OF 1876.

From the preceding statement of facts, and from the detailed history of the invasion of 1876, it becomes obvious that this invasion was made up, 1st, of such insects as hatched out in southwest Minnesota, and parts of Colorado, Wyoming and Dakota; 2d, of additions to these from Montana and British America. In how far those in either of these categories were made up of the progeny from the insects that left our country in 1875 we shall never be able accurately to determine. The proportion of parasitized and diseased insects that left Missouri, doubtless became less among those which hatched and rose from the farther north and west, and we may, I think, take it for granted that the larger part of the swarms that reached Montana and British America, laid eggs. In addition to the vast beevies which invaded the northwest from the south and southeast, there were in 1875, as Prof. Dawson shows, others that hatched in the northwest, pouring from British America into our Northwest territory. There were, in fact, in Manitoba, and large parts of the Northwest, two grand opposing movements of the winged insects, which thus replaced each other. And bearing this in mind, we can understand the increased area in the Northwest over which eggs were laid that year, and from which the 1876 swarms had their source. As no eggs were laid in Manitoba, while the young are known to have abounded in the moun-

tain region to the west of that province, it is more than probable that the principal source of the 1876 invasion was Montana and the Saskatchewan and Swan River countries. The question as to how far the northwest breeding grounds are recruited by the insects which hatch in the more fertile country which I have designated as outside the species' natural habitat, is a most interesting one; for if thus recruited there is all the greater incentive for us to exterminate the young insects which hatch with us. All such questions can only be settled by a thorough study of the subject by a properly constituted commission, charged by Congress with the work.

#### EASTERN LINE REACHED.

A study of the eastern limit of the invasion of 1876, compared with that of 1874, shows that it is peculiar in reaching farther east in Minnesota and Iowa, and farther south and east in Texas. The limit-line—extending from Clay county, Minnesota; bulging toward St. Paul, reaching southwardly to the center of Iowa; thence westwardly receding to Lawrence, Kansas, and bulging again to Southwest Missouri—is more irregular between the 36th and 46th parallels than it was in 1874. On an average, however, it does not extend east of the 94th meridian.

#### RATE AT WHICH THE INSECTS SPREAD.

Leaving Montana about the middle of July the insects reached far into Texas by the end of September, thus extending about 1,500 miles in 75 days, or an average of about 20 miles per day. But over a large part of this territory, viz., portions of Wyoming, most of Dakota and Nebraska, W. Minnesota, N. W. Iowa, N. W. Kansas, and N. E. Colorado—they appeared almost simultaneously, or during the last few days of July and the first few day of August; and this, I think, indicates that they were at that time swept down at a very much higher rate by the N. W. winds from Montana and British America. After that time the extension S. was tolerably rapid, but the extension E. was more and more slow. They occupied nearly a month reaching from N. W. Iowa to the S. W. limit in the same State, and their eastward progress on the confines of the limit line already indicated was still more gradual as they went South. All of which indicates that they fly most powerfully when leaving the higher altitudes of the N. W., and most persistently during the first week or so after becoming fledged, while the females are not yet prompted to descend for oviposition. This is also the period when they are passing over the vast plains and the sparsely settled and uncultivated portion of the country, in which there is, perhaps, least inducement for the ravenous host to halt.

As flight is not consecutive day after day, but often impeded by bad weather, and as it is not continuously in one direction, the average rate is not more than 20 miles a day. It is also most variable and at times reaches a maximum of between two and three hundred miles daily.

#### DIRECTION OF FLIGHT.

The wind was quite changeable during the period of invasion, and we find the insects, at one time or another, traveling in nearly all possible directions, except due west. Yet, if we except the departing swarms which flew from N. W. Minnesota in July, the direction of the invading hosts was, as I believe it always has been and always will be, conspicuously S. and S. E. The exceptions were principally during the first week in August, when they swept S. W. from Minnesota over parts of Iowa and Nebraska; and two months later when they were carried N. E. into our S. W. counties.

#### INFLUENCE OF THE WIND IN DETERMINING THE COURSE OF LOCUST SWARMS.

That excessive multiplication and hunger are the principal causes of migration from the native home of the species, and that the prevailing winds determine the course therefrom, I have endeavored to show (Reps. 7, p. 104; 8, p. 112). That all these influences very largely determine the return migration when the insects hatch out in the Mississippi Valley is also doubtless true; and it is interesting to note in this connection that, according to observations, covering a period of from two to five years, furnished by General Myer, at the request of Dr. A. S. Packard, Jr.,\* the prevailing winds in May and June, within the region subject to invasion, are from the Gulf of Mexico, or from the S. E. and S., *i. e.* in the opposite direction, prevails later in the season. Yet, to assume that the migrations are solely dependent for direction on the winds would be incorrect, as there is cumulative evidence (much of it recorded in these Reports) that when once the migration has commenced, adverse winds only retard, but do not materially change its course.

#### LOCUST FLIGHTS EAST OF THE MISSISSIPPI.

To the unscientific mind there are few things more difficult of apprehension than that species, whether of plants or animals, should be limited in geographical range to areas not separated from the rest of the country by any very marked barriers, or by visible demarcations. Yet it is a fact well known to every naturalist, and the geo-

\* "The Destructive Locust of the West," *Am. Naturalist*, Vol. XI, p. 27.

graphical distribution of species forms at once one of the most interesting and one of the most important studies in natural history. Some species have a very limited, others a very wide range; and while in the course of time—in the lapse of centuries or ages—the limits have altered in the past and will alter in the future, they are, for all practical purposes, permanent in present time. These limits may in fact, for the purpose of illustration, be likened to those which separate different nations. Though frequently divided by purely imaginary lines, the nations of Europe, with their peculiar customs and languages, are well defined.

Along the borders where the nations join, there is sometimes more or less commingling; at other times the line of demarkation is abrupt; and in no case could emigrants from the one, long perpetuate their peculiarities unchanged in the midst of the other. Yet in the battle of nations, the lines have changed, and the map of Europe has often been remodeled. So it is with species. On the borders of the areas not abruptly defined, to which species are limited, there is more or less modification from the typical characters and habits; while in the struggle of species for supremacy, the limits may vary in the course of time. The difference is, that the boundaries of nations result from human rather than natural agencies, while those of species result most from the latter, and are therefore more permanent. These remarks apply of course to species in a natural state and where their range is uninfluenced either directly or indirectly by civilized man.

I found some difficulty at the late Conference of Governors at Omaha to consider the locust problem, in satisfying those present that the Rocky Mountain Locust could not permanently thrive south of the 44th parallel, or east of the 100th meridian, and that there was no danger of its ever extending so as to do serious damage east of a line drawn a little west of the centre of Iowa. They could not see what there was to prevent the pest from overrunning the whole country, and thought that Congress should be appealed to, not only on behalf of the country that has suffered from its ravages, but on behalf also of the whole country that is threatened therefrom.

Having discussed in my two previous Reports the native home of the species, and the conditions which prevent its permanent settlement in the country to which it is not native, it is unnecessary here to go into detail on these points. Briefly, the species is at home and can come to perfection only in the high and dry regions of the Northwest, where the Winters are long and cold and the Summers short; and whenever it migrates and oversweeps the country to the south or

southeast, in which it is not indigenous, the changed conditions are such that the first generation hatched out in that (to it) unnatural climate, either forsakes it on the wing or perishes from debility, disease and general deterioration. On the soundness of this conclusion depends the future welfare of most of the more fertile States between the Mississippi and the mountains, and science, as well as past experience, show it to be sound. Upon this hypothesis the people of nearly the whole country so scourged during the past year, and so threatened next Spring, may console themselves that the evil is but temporary: they may have to fight their tiny foe most desperately next Spring, but they have also the assurance that even if he prove master of the field, he will vacate in time to, in all probability, allow of good crops of some of the staples, and that he may not return again for years. On the other hypothesis—for which there is only apparent, and no real reason—ruin stares them inevitably in the face.

The causes which limit the eastward flight of the winged swarms that come from the Northwest are, with the majority of people, still more difficult to appreciate; for most persons can see no reason why a swarm that overruns the western portions of Minnesota, Iowa and Missouri, should not extend to the eastern borders of the same States, or into Illinois, Indiana, Ohio and eastward. Having previously considered the more occult climatic influences that bear on the belief that they never will, I need only state here, that the principal arguments rest in the facts that—1st, the power of flight of any insect that has a limited winged existence, must somewhere find a limit; 2d, that all past experience has shown that *Caloptenus spretus* has never extended, in a general way, beyond the limit indicated, and that as long as the present average conditions of wind and climate prevail, it is reasonable to suppose that it never will.

One of the principal difficulties in the way of a proper apprehension of the facts, is found in the failure, in the popular mind, to discriminate between species. The ordinary newspaper writer talks of *the* grasshopper, or *the* locust, as though all over the country and all over the world there was but one and the same species. One of the Governors present at the Conference referred to, was at first fully of the belief that our Rocky Mountain pest came all the way from Asia. In the case of this destructive species, even some entomologists have added to the difficulty by erroneously claiming that it is common all over the country to the Atlantic ocean.

The above thoughts were suggested by the following reports, that met my eye, in the *Cincinnati Gazette* of the 24th of October, from Dayton and Hamilton, respectively, in the State of Ohio:

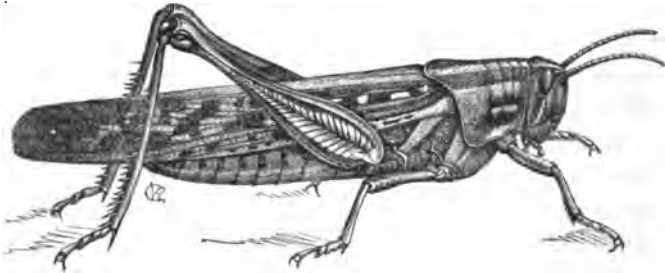


The advent of Kansas grasshoppers, over Sunday and until Monday evening, in great numbers throughout the city, is a most remarkable incident. They were found early Sunday morning, and left, as suddenly as they came, on Monday evening.

A shower of mammoth grasshoppers came down upon our town and vicinity on Saturday night. We have never seen such large ones before, and we understand from old citizens, that they are entire strangers in this part of the country. We saw a boy have a string tied to two of them (which were as long as a man's finger) trying to drive them, and he succeeded pretty well.

A flock of grasshoppers alighted in Hamilton about 11 o'clock on Saturday night, from the northwest. Those that were not drowned in the river or killed by the heavy rain, were probably gobbled up before Sunday night by the chickens.

[Fig. 17.]



AMERICAN ACRIDIMUM.

Such reports as these very naturally confirm the unscientific in the idea that the locust plague of the West, or so-called "Kansas grasshopper," has overstepped the limits entomology ascribes to it, and is upsetting the conclusions which I have come to. The same swarm passed over Oxford in the same State, in a southwesterly direction, and fortunately that veteran and well-known apiarian, the Rev. L. L. Langstroth, who has not forgotten to be a close observer, had specimens sent to me. They proved to be the American Acridium (*Acridium Americanum*). As stated in my 8th Report, this is one of the largest and most elegant of our N. A. locusts, the prevailing color being dark brown, with a pale yellowish line along the middle of the back when the wings are closed. It has a wide range, hibernates in the winged condition, and differs not only in size and habits from the Rocky Mountain Locust, but entomologically is as widely separated from it as a sheep from a cow. It is a species common over the country every year, and during exceptional years becomes excessively numerous and acquires the migratory habit, its wings being long and well adapted to flying. As I learn from Dr. S. Miller of Franklin, it passed in swarms over part of Johnson county, Missouri, late in September; and it was everywhere abundant in 1876.

The following extracts from letters of correspondents refer to this species:

I send you by Mr. Shaw a small package containing specimens of locusts, destructive about Chattanooga and in all eastern Tennessee. They strike me as nearly allied to the Rocky Mountain Locust; fly with the same noise and shine of wings, in large shoals, but are larger.—[Dr. G. Engelmann, Warm Springs, N. C., Aug. 29, 1876.]

We have a locust here which has in some places occurred in considerable numbers, and some people think it the same as the one which has produced so much damage in the West. This I doubt, as it is evidently a native species.—[E. M. Pendleton, Prof. of Agriculture, Un. of Ga., Atlanta, Ga., Sept. 14, 1876.]

The American *Acridium* visited us on the night of November 21, (Saturday.) A rain fell during the night. Cambridge City, Indiana, was also visited by them on the same night.—[Herschel I. Fisher, Eastham College, Richmond, Ind.]

Toward the end of July the unfledged insects did an immense amount of damage to the cotton and other crops of Georgia and South Carolina. The papers were full of graphic accounts of their destruction, and editors not only very generally took it for granted that they had to do with the western *spretus*, but Mr. T. P. Janes, Commissioner of Agriculture for Georgia, in his circular No. 27, supposed they were the same. Specimens which he subsequently sent me, however, at once revealed their true character.

The damage done by some of the more common locusts that occur over the country, is, let me repeat, sometimes very great, especially during hot, dry years. In some of the New England States their ravages have, in restricted localities, fairly equalled those of the voracious *spretus* of the West. But while a few of them, under exceptional circumstances, develop the migratory habit, they none of them ever have, and in all probability never will, compare to *Caloptenus spretus* in the vastness of its migrations and in its immense power for injury over extensive areas.

Whenever we hear of locust flights east of the Mississippi, we may rest satisfied that they are not of our Rocky Mountain pest, and are comparatively harmless.

#### DOES THE FEMALE FORM MORE THAN ONE EGG-MASS?

Whether the female of our Rocky Mountain Locust lays her full supply of eggs at once, and in one and the same hole; or whether she forms several pods at different periods, are questions often asked, but which have never been fully and definitely answered in entomological works. It is the rule with insects, particularly with the large number of injurious species belonging to the Lepidoptera, that the eggs in the ovaries develop almost simultaneously, and that when oviposition once commences, it is continued uninterruptedly until the supply of eggs is exhausted. Yet there are many notable exceptions to the rule among injurious species, as in the cases of the common Plum Curculio and the Colorado Potato-beetle, which oviposit at stated or irregular intervals during several weeks, or even months. The Rocky Mountain Locust belongs to this last category, and the most casual examination of the ovaries in a female, taken in the act of ovipositing, will show that besides the fully formed eggs then and there being laid, there are other sets, diminishing in size, which are to be laid at future periods. This, I repeat, can be determined by any one who will take

the trouble to carefully examine a few females when laying. But just how often, or how many eggs each one lays, is more difficult to determine. With *spretus* I have been able to make comparatively few experiments, but on three different occasions I obtained two pods from single females, laid at intervals of 18, 21 and 26 days respectively. I have, however, made extended experiments with its close congeners, *femur-rubrum* and *Atlantis*, and in two cases, with the former, have obtained four different pods from one female, the laying covering periods of 58 and 62 days, and the total number of eggs laid being 96 in the one case and 110 in the other. A number of both species laid three times, but most of them—owing, perhaps, to their being confined—laid but twice. They couple with the male between each period, and I have no doubt but that, as in most other species of animals, there is great difference in the degree of individual prolificacy.

We may, therefore, feel tolerably confident that the Rocky Mountain Locust will sometimes form as many as four egg-pods.

The time required for drilling the hole and completing the pod will vary according to the season and the temperature. During the latter part of October or early in November last year, when there was frost at night and the insects did not rouse from their chilled inactivity until 9 o'clock A. M., the females scarce had time to complete the process during the four or five warmer hours of the day; but with higher temperature not more than from two to three hours would be required.

#### HOW THE EGGS ARE LAID.

The question as to how best to treat the soil, or to manage the eggs so as to most easily destroy their vitality, is a most important

[Fig. 18.]

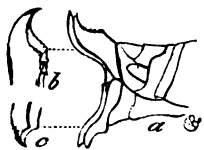


ROCKY MOUNTAIN LOCUST:—a, a, a, female in different positions, ovipositing; b, egg-pod extracted from ground, with the end broken open; c, a few eggs lying loose on the ground; d, e, shows the earth partially removed, to illustrate an egg-mass already in place, and one being placed; f, shows where such a mass has been covered up.

other author.

and practical one, and as assisting to a decisive answer, I have carried on a series of experiments, which will be presently detailed. To make the experiments the more intelligible, I will first give the reader a deeper insight into the philosophy of the processes of egg-laying and of hatching than I have hitherto done, and this the more readily that it has never been given by any

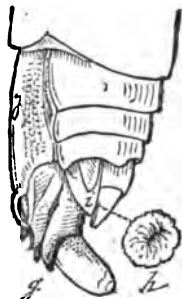
I have already explained (Rep. 7, p. 122) how, by means of the horny valves at the end of her abdomen (Fig. 19) the female drills a cylindrical hole in the ground in which to consign her eggs. The curved abdomen stretches to its utmost for this purpose, and the hole is generally a little curved and is always more or less oblique, (Fig. 18, *e. d.*) If we could manage to watch a female



ROCKY MOUNTAIN LOCUST:—Anal characters of female, showing horny valves.

during the arduous work of ovipositing we should find that, when the hole is once drilled, there commences to exude at the dorsal end of the abdomen, from a pair of sponge-like exsertile organs (Fig. 20, *h*) that are normally retracted and hidden beneath the super-anal plate, (Fig. 20, *i*) near the cerci, a frothy, mucous matter, which fills up the bottom of the hole. Then, with the two pairs of valves brought close together, an egg would be seen to slide down the oviduct (*j*) along the ventral end of the abdomen, and, guided by a little finger-like style,\* (*g*) pass in between the horny valves (which are admirably constructed, not only for drilling, but for holding and conducting the egg to its appropriate place) and issue at their tips amid the mucous fluid already spoken of. Then follows a period of convulsions, during which more mucous material is elaborated, until the whole end of the body is bathed in it—when another egg passes down and is placed in position. These alternate processes continue until the full complement of eggs are in place, the number ranging from 20 to 35, but averaging about 28. The mucous matter binds all the eggs in a mass, and when the last is laid the mother devotes some time to filling up the somewhat narrower neck of the burrow with a compact and cellulose mass of the same material which, though light and easily penetrated, is more or less impervious to water, and forms a very excellent protection. (Fig. 21, *d.*)

[Fig. 20.]



OVIPOSITION OF ROCKY MOUNTAIN LOCUST.

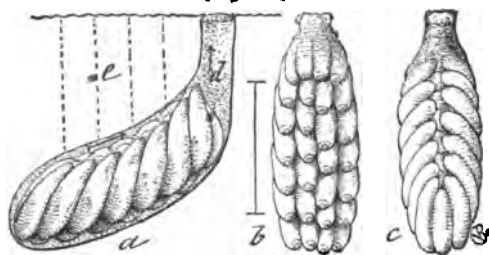
#### PHILOSOPHY OF THE EGG-MASS.

To the casual observer the eggs of our locust appear to be thrust indiscriminately in the hole made for their reception. A more careful study of the egg-mass or egg-pod will show, however, that the female took great pains to arrange them, not only so as to economize as much space as possible consistent with the form of

\*This is a simple process or extension of the sternite, not particularized, that I am aware of, by any author. It may be known as the egg-guide or *gubernaculum ovi*.

each egg, but so as to best facilitate the escape of the young locust; for as the bottom eggs were the first laid and are generally the first to hatch, their issue would, in their efforts to escape,

[Fig. 21.]



EGG-MASS OF ROCKY MOUNTAIN LOCUST:—*a*, from the side, within burrow; *b*, from beneath; *c*, from above—enlarged.

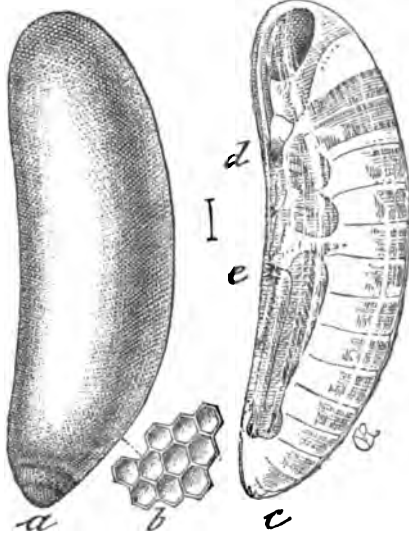
disturb and injure the other eggs, were there no provision against such a possibility. The eggs are, indeed, most carefully placed side by side in four rows, each row generally containing seven. They oblique a little, crosswise of the cylinder. (Fig. 21, *a*). The posterior or narrow end which issues first from the oviduct is thickened, and generally shows two pale rings around the darker tip (Fig. 22, *a*). This is pushed close against the bottom of the burrow which, being cylindrical, does not permit the outer or two side rows to be pushed quite so far down as the two inner rows; and for the very same reason the upper or head ends of the outer rows are necessarily bent to the same extent over the inner rows—the eggs when laid being somewhat soft and plastic. There is, consequently, an irregular channel along the top of the mass. (Fig. 21, *c*) which is filled only with the same frothy matter which surrounds each egg and occupies all the other space in the burrow not occupied by the eggs. The whole plan is seen at once by a reference to Figure 21, which represents enlarged, a side view of the mass within the burrow (*a*), and a bottom (*b*) and top (*c*) view of the same, with the earth which adheres to it, removed.

#### HOW THE YOUNG LOCUST ESCAPES FROM THE EGG.

Carefully examined, the egg-shell is found to consist of two layers. The outer layer which is thin, semi-opaque, and gives the pale cream-yellow color, is seen by aid of a high magnifying power to be densely, minutely and shallowly pitted; or, to use still more exact language, the whole surface is netted with minute and more or less irregular, hexagonal ridges (Fig. 22, *a*, *b*). The inner layer is thicker, of a deeper yellow, and perfectly smooth. It is also translucent, so that, as the hatching period approaches, the form and members of the embryo may be distinctly discerned through it. The outer covering is easily ruptured, and is rendered all the more fragile by freezing; but the inner covering is so tough that a very strong pressure between one's thumb and finger is required to burst it. How, then, will the embryo, which fills it so compactly that there is scarcely room for motion,

succeed in escaping from such a prison? The rigid shell of the bird's egg is easily cracked by the beak of its tenant; the hatching caterpillar, curled within its egg-shell, has room enough to move its jaws and eat its way out; the egg-coverings of many insects are so delicate

[Fig. 22.]



EGG OF ROCKY MOUNTAIN LOCUST:—*a*, showing sculpture of outer shell; *b*, the same very highly magnified; *c*, the inner shell just before hatching; *d*, *e*, points where it ruptures.

and frail that the mere swelling of the embryo affords means of escape; those of others so constructed that a door flies open, or a lid lifts by a spring, whenever pressure is brought to bear: in some, two halves open as in the shell of a muscle; whilst in a host of others the embryo is furnished with a special structure, called the egg-burster, the office of which is to cut or rupture the shell, and thus afford means of escape. But our young locust is deprived of all such contrivances, and must use another mode of exit from its tough and sub-elastic prison. Nature accomplishes the same end in many different ways.

She is rich in contrivances. Every one who has been troubled by it must have noticed that the shanks (tibiæ) of our locust, as of all the members of its family, are armed with spines. On the four anterior legs, these spines are inside the shank; on the long posterior legs, outside. The spines of the hind shanks are strongest, and the terminal ones on all legs stronger than the rest. There can be no doubt that these spines serve to give a firm hold to the insect in walking or jumping; but they have first served a more important pre-natal purpose.

When fully formed, the embryo is seen to lie within its shell, as at Fig. 22, *c*. The antennæ curve over the face and between the jaws, which are early developed, and, with their sharp, black teeth, reach onto the breast. The legs are folded up on the breast, the strong terminal hooks on the hind shanks reaching toward the mesosternum. Now the hatching consists of a continued series of undulating contractions and expansions of the several joints of the body, and with this motion there is slight but constant friction of the tips of the jaws and of the sharp tips of the hind tibial spines, as also of the tarsal claws of all the legs against the shell, which eventually weakens

between the points *d* and *e*, and finally gives way there. It then easily splits up to the eyes or beyond, by the swelling of the head.

By the same undulating movements the nascent larva soon works itself entirely out of the egg, when it easily makes its way along the channel already described, without in the least interfering with the other eggs, and finally forces a passage-way up through the mucous filling in the neck of the burrow (Fig. 21, *d*). Once fully escaped from the soil, it rests from its exertions, but for a short time only. Its task is by no means complete: before it can feed or move with alacrity it must molt a pellicle\* which completely encases every part of the body. This it does in the course of three or four minutes, or even less, by a continuance of the same contracting and expanding movements which freed it from the earth, and which now burst the skin on the back of the head. The body is then gradually worked from its delicate covering until the last of the hind legs is free and the exuvium remains, generally near the point where the animal issued from the ground, as a little, white, crumpled pellet. Pale and colorless at first, the full-born insect assumes its dark-gray coloring in the course of half an hour.

From this account of the hatching process, we can readily understand why the female in ovipositing prefers compact or hard soil to that which is loose. The harder and less yielding the walls of the burrow, the easier will the young locust crowd its way out.

The covering which envelops the little animal when first it issues from the egg, though quite delicate, undoubtedly affords protection in the struggles of birth from the burrow, and it is an interesting fact that while it is shed within a few minutes of the time when the animal reaches the free air, it is seldom shed if, from one cause or other, there is failure to escape from the soil, though the young locust may be struggling for days to effect an escape.

While yet enveloped in this pellicle, the animal possesses great forcing and pushing power, and if the soil be not too compact, will frequently force a direct passage through the same to the surface, as indicated at the dotted lines, Fig. 21, *e*. But it can make little or no headway, except through the appropriate channel (*d*), where the soil is at all compressed. While crowding its way out, the antennæ and four front legs are held in much the same position as within the egg, the hind legs being generally stretched. But the members bend in every conceivable way, and where several are endeavoring to work through any particular passage, the amount of squeezing and crowding they will endure is something remarkable. Yet if by chance the

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\* This pellicle (the *ambion*) is common to most Orthopterous and Neuropterous insects.

protecting pellicle is worked off before issuing from the ground, the animal loses all power of further forcing its way out. The instinctive tendency to push upwards is also remarkable. In glass tubes, in which I have had the eggs hatching in order to watch the young, these last would always turn their heads and push toward the bottom whenever the tubes were turned mouth downward; while in tin boxes where the eggs were placed at different depths in the ground, the young never descended, even when they were unable to ascend on account of the compactness of the soil above.

#### ADDITIONAL NATURAL ENEMIES.

The enemies of the Rocky Mountain Locust may be divided into those which destroy the eggs and those which attack and destroy the active insects.

*Animals which destroy the eggs.*—In addition to the Black-bird and Prairie Chicken, previously mentioned as feeding on the eggs, Mr. Geo. F. Gamner, of Lawrence, Kans., has found the Lapland Longspur (*Plectrophanes lapponicus*), the Horned Lark (*Eromophila cornuta*) and the Quail doing the same good work, feeding especially on such eggs as are exposed by freezing and thawing. Mr. J. W. Robson, of Cheever, Kans., has found the Skunk and Striped Squirrel destroying large numbers of the eggs, and the Greeley (Col.) Sun reports five acres of land dug all over by the former animal in search of them. The Silky Mite (*Trombidium sericum*), the habits of which were related in my 7th Report, did much good in destroying the eggs in the more northern States. In parts of Minnesota it reduced them to a powder over extensive areas, and as the power of these minute scarlet bodies for good as egg-destroyers has been questioned, I give the following reports, which tell their own story :

Last evening, when we reached Worthington from Lake Shetek, there was quite an excitement in Worthington, owing to the fact that the citizens were generally convinced that a red parasite was destroying the grasshopper eggs. I examined the matter carefully myself, and became convinced that the destruction of the eggs in that immediate vicinity was well assured; but I determined not to write you and excite any hope until a further and more complete examination could be had. We therefore furnished our Bohemian friends with a bottle of the eggs and *their pests*, and the commission left in high spirits. We postponed further investigation until this morning, when I left and prosecuted the examination with vigor. The farmers in the vicinity knew nothing of these signs of deliverance until the visitors from Worthington reached them, and I feel safe in saying to you that in a circle of ten miles from Worthington there will scarcely be an egg left by to-morrow night. I send you a bottle herewith containing the cones and the parasites. We could scarcely find a cone or sack, except as they were indicated by the parasite on the surface; and each cone, which was not entirely destroyed, had from five to fifty of the red laborers at work upon the eggs. We found scores of cells with no eggs left, except the shells.

\* \* \* \* \*

I stopped for fifteen minutes one-and-a-half miles west of Wilder, where Section Foreman Smith took me to that portion of his farm where eggs were deposited. We could find none by general digging, but wherever we tumbled, as we frequently did, the red parasite on the surface, we found the cone beneath, with the parasite at work con-



suming the eggs. \* \* \* I am aware that two years ago this parasite was found working upon the eggs at Madelia and other places, but here we have the remedy almost as soon as the eggs are laid, while in the former instances the parasite was only discovered in the Spring.—[Letter from Ex-Gov. Stephen Miller, written from Win-  
dom, Minn., Aug. 15, 1876.

We send herewith a box of grasshopper eggs, together with the "silky mite," of which so much has been said. You can see a sample of the work they are doing. They are over the ground and in it wherever eggs have been laid. They suck the eggs, leaving the bare shell. We have talked with farmers from all parts of the county, and they all tell the same story—not a cell to be found that is not partially or wholly destroyed.

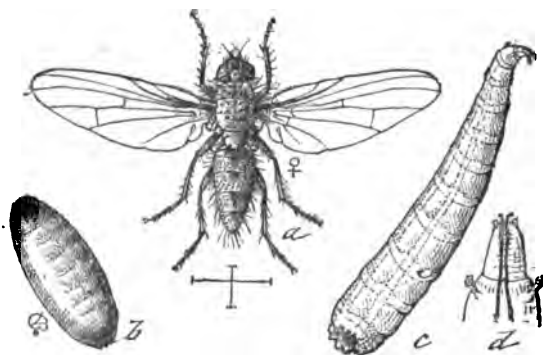
We have personally inspected them in more than twenty different places, and are satisfied that in this county the eggs of the festive G. H. are a "total wreck." Allow us to suggest that you call for a report from every county in the State that has been infested by them.—[Letter to *Pioneer Press and Tribune*, from Bell & Gruelle, Worthington, Nobles Co., Minn., Aug. 16, 1876.

I send, enclosed in a circular tin box, mailed with this, some dirt containing grasshopper's eggs, and also the *red mite* or *spider* that sucks them, as you will perceive on examination. I trust they will be received in good order. I send them at the request of A. Whitman, of St. Paul, of this State, with whom I am corresponding sometimes on this grasshopper matter.—[Letter from R. B. Potts, U. S. N., Worthington, Minn., August 18, 1876.

Up to the past autumn the Silky Mite was the only parasite that was known to attack the eggs of our locust, though a small Chalcid-fly\* had been bred by Mr. S. H. Scudder, from those of the Carolina Locust, a large species with blue and black hind wings; and two Ichneumon-flies were known to attack locust eggs in Europe. The present year five new insect enemies have been found attacking these eggs almost everywhere throughout the infested country, and these I will proceed to describe.

THE ANTHOMYIA EGG PARASITE, (*Anthomyia radioum*, var. *calopteni*.)—This is by far the most wide-spread and generally useful of the

[Fig. 23.]



ANTHOMYIA EGG-PARASITE:—a, fly; b, pupa; c, larva from side; d, head of same from above—enlarged.

different egg enemies. It has occurred in Minnesota, Iowa, Nebraska, Kansas, Missouri and Texas, and wherever I have examined the locust eggs, whether in Missouri, Kansas or Nebraska, I have found it destroying on an average about ten per cent. of them. It is the enemy referred to by Mr. Jno. D. Dopf, of Atchison,

and by Mr. J. D. White, of Holt county, in the reports from Missouri,

\*A similar, if not the same Chalcid, infests the eggs of *spretus*, for Mr. Potts has sent me egg-masses in which every egg had a Chalcid pupa. Unfortunately, they were too dry when received to permit of rearing the imago.

(ante, pp. 68, 72.) and the following items will serve as samples of many others that referred to the same parasite:

Recently a white worm or maggot has been discovered in the locust eggs laid in this vicinity, and so generally are the grubs that we really look for a great diminution in next year's locust crop. About the time the hoppers began laying eggs we had a hard, soaking rain, and since then we have had several more—the last this morning. By this time the ground is well soaked with water and the eggs were and are laid in earth that is quite moist. It is about two weeks since the hoppers first reached Mankato, they have laid many eggs, and already this worm or maggot has developed and seems to be on the increase, being found in the egg cells, where it sucks or destroys the egg. Some cells that I have opened have had two and three worms in them.—[From a letter from J. C. Wise, Mankato, Minn., August 20, 1877.]

On the ninth I sent you a box of locust egg parasites, and to-day I will send you some more of different sort: or different stages of development or both. I find them more plentiful to-day than before. The ground seems to be full of them from 5 to 20 of the small white worms in a single cell, one generally, though sometimes two of the large white ones in a cell. The reddish covered ones I suppose are in a different stage of development, though the same parasite. In every cell in which I have found any of those sent you the eggs were nearly or quite destroyed. But there is another, and a far more destructive enemy, viz: the hot sun, which is hatching them out by the million, though the parasites may continue their work after it ceases to operate. I shall be happy to do all I can to aid you in your investigations—[Letter from C. E. Treadwell, Rockport, Atchison county, October 16, 1876.]

Yesterday we discovered on a warm southern exposure that our locust eggs were hatching out maggots. We break open the cocoons and the eggs on exposure to the sun for a few moments crawl away a worm. In warm places along the hedges the earth is alive with them. Is this a new development of the locust question? It would seem to be a confirmation of the theory you promulgated, as I understood it, at the time. I secured a few of the perfect cocoons which I enclose for your examination. We suppose these will do as the others do upon exposure to the sun.

The people here are quite excited over the matter, hoping it may be a solution of the problem for next year, at least, and have deputed me to lay the matter before you. Any information you can give us in regard to this our latest development, will be thankfully received and acknowledged—[Letter from S. M. Pratt, M. D., Hiawatha, Brown county, Kansas, October 30, 1876.]

Various reports have been circulated in regard to the destruction of the eggs of the Rocky Mountain Locust (*Caloptenus spretus*) by a worm. I am happy to state that these reports were substantiated yesterday by Mr. McLockhead of Deer Creek, Kanawaka, twelve miles west of this city, who brought me a box of earth in which the eggs of the "hopper" had been abundantly deposited. To-day a similar box was secured from W. B. Barnett, Esq., of Hiawatha, Brown county. In both of these instances a large proportion of the eggs have been destroyed by a small, white larvæ. Many of the egg-cases, which ordinarily each contain from twenty to thirty eggs, had no eggs in them, but were full of these worms or larvæ, each one of which took the place of an egg which it had destroyed. Some of the egg-cases contained only two or three larvæ with more than twenty sound eggs. I consider these to be the larvæ of a parasitic Hymenopterous insect [It was subsequently verified as the *Anthomyia* under consideration] which I hope to obtain in the winged or perfect state, if I succeed in carrying them safely through their transformation—[Prof. F. H. Snow, in *Lawrence* (Kansas) *Journal*, November 1, 1876.]

This good little friend, which simultaneously prevailed over so large an extent of country, is a small white maggot, (Fig. 23, c) of the same general form of the common meat maggots or "gentiles," but measuring, when full grown and extended, not quite  $\frac{1}{4}$  of an inch in length. The head, with some of the anterior joints of the body, tapers and is retractile, and the jaws consist of two small hooks joined to a V-shaped, black, horny piece which, as it is retracted or extended, plays beneath the transparent skin. The hind or tail end

is squarely docked off, and contains two small yellowish-brown, eye-like spots, which are the principle spiracles or breathing pores.

These small maggots are found in the locust egg-pods, either singly or in varying numbers, there sometimes being a dozen packed together in the same pod. They exhaust the juices of the eggs and leave nothing but the dry and discolored shells, and where they are not numerous enough to destroy all the eggs in the pod, their work, in breaking open a few, often causes all the others to rot.

When fed to repletion this maggot contracts to a little cylindrical, yellowish-brown pupa, (Fig. 23, *b*) about half the length of the out-stretched and full-grown larva, and rounded at both ends. From this pupa, in the course of a week in warm weather, and longer as the weather is colder, there issues a small, grayish, two-winged fly, (Fig. 23, *a*) about  $\frac{1}{4}$  of an inch long, the wings expanding about  $\frac{1}{2}$  of an inch, and in general appearance resembling a diminutive house-fly, except that the body is more slender and more tapering behind, and the wings relatively more ample. More carefully examined, the body is seen to be of an ash-gray color, tinged with rust-yellow, and beset with stiff bristle-like hairs, those on the thorax stoutest, and those on the abdomen smaller but more uniformly distributed. The wings are faintly smoky and iridescent. There are three dusky longitudinal stripes on the thorax, most distinct anteriorly, and another along the middle of the abdomen, most distinct in the male, which also differs from the female in the larger eyes, which meet much more closely on the top of the head than in the female, and in the face being whiter.

The Winter is passed mostly in the pupa state, though doubtless in some cases also in the winged state.

The flies of this genus are characterized by the shortness of the antennæ, and by the attenuated abdomen. The characters given to it are, however, by no means uniform, and as the species generally bear a very close resemblance to each other, and there have been a large number described in Europe, (many of them very imperfectly), it becomes almost an impossibility to properly determine them. As the sexes often differ materially, it is also, except where they are reared from the larva, difficult to connect them, and as the colors often become sordid and dull in the cabinet, many of the described species have no real existence.

The flies frequent flowers, and often congregate and play in swarms in the air. Their eggs are white, smooth, oval, about 0.04 inch long, and are dropped near the food of the larva. In the larva state these insects mostly feed on leguminous plants, and the carnivorous habit is exceptional. The species affecting the Cabbage, the Onion, the

Radish etc., have received different names as *brassicæ*, *ceparum*, *raphani*, etc., but several of them doubtless constitute but one species. A comparison of those reared from the locust eggs with the descriptions of *brassicæ* and *ceparum* has not enabled me to discover any constant differences, and they should perhaps all be referred to *radicum* Linn. At all events I feel that it is safest to define the insect under consideration merely as a variety of that species, leaving the proper determination of it to the future monographer of the genus.

The probabilities are that, feeding normally on the roots of various plants, it found locust eggs to its liking, and multiplied rapidly as a result of the abundance of such eggs.

*ANTHOMYIA RADICUM* (Linn.) var. *CALOPTENI*—Egg—Oval, smooth, white, 0.04 inch long.

*Larva*—Skin unarmed, 0.24 inch long when extended, of the normal form, the mandibular hooks black, quite conspicuous, and diverging at base. Prothoracic spiracles elongate. Anal spiracles minute, yellowish-brown, with the 8 fleshy surrounding tubercles, small.

*Pupa*—Pale-brown, rounded at each end, with the prothoracic spiracles and lips anteriorly, and the anal spiracles and lower tubercles posteriorly, showing as minute points.

*Imago*—♀. Average expanse 0.48 inch. General color ash-gray with a ferruginous hue, especially above, and a more or less intense metallic reflection. Face with white reflections below; eyes smooth, brown, encircled by the ground color, and this behind and on forehead bordered by a brown line; 2 similar lines at back of head from upper corners of eyes and approaching to neck; forehead dusky-brown, becoming bright yellowish-red toward base of antennæ, and the brown forking at right angles around occiput. Trophi and antennæ black, the style simple and somewhat longer than the whole antennæ. Thorax with three dusky longitudinal lines, obsolete behind; legs black, with cinereous hue beneath; wings faintly smoky, with brown-black veins, the discal cross-vein straight and transverse, the outer one bent and more oblique; balancers crumpled, yellowish. Abdomen with faint dusky medio-dorsal spots, broad at base, tapering and obsolescing toward end of each joint.

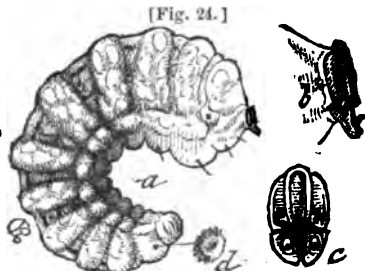
In the ♂, aside from the larger eyes, stronger bristles, and narrower, less tapering abdomen with its additional joint—all characteristic of the sex—the face is whiter, and the medio-dorsal dark mark of abdomen continuous.

Described from 25 specimens of both sexes, reared from locust-egg-feeding larvae.

Specimens bred from cabbage and radish roots, and others in my cabinet taken from the burrows (made in Osage Orange in Missouri) of *Crabro stirpicola* Pack.; do not differ specifically.

THE COMMON FLESH FLY (*Sarcophaga carnaria*, L.)—The red-tailed variety (*sarraceniae*) of this ubiquitous insect, described and figured in my 7th Report (p. 180) as preying on the locust, also attacks its eggs. It is a larger maggot than the preceding, and contracts to a darker pupa which is not similarly rounded at each end, but has the hind end truncate, and the front end tapering. It sucks the eggs, as does the *Anthomyia* larva, but the parent fly is probably attracted to those, principally, which are addled or injured, as the pods in which I have found it have very generally been in a fluid state of decay. From three quarts of eggs I have obtained 26 of these flies.

**UNDETERMINED SPECIES.**—Next to the *Anthomyia* Egg-parasite, in importance, is a much larger, more sluggish, yellowish grub, (Fig. 24) measuring about  $\frac{1}{2}$  an inch when extended, which is found within or beneath the locust eggs, lying in a curved position, the body being bent so that the head and tail nearly touch each other. It is a smooth grub, with a very small, brown, flattened head, with the joints near the head swollen and the hind end tapering, and with deep, translucent sutures beneath the joints, which sutures show certain vinous marks and mottlings, especially along the middle of the back. It exhausts the eggs, and leaves nothing but the shrunken and discolored shells. It has not yet been reared to the perfect state, but from the structure of its mouth it is evidently Hymenopterous, and will produce, without much doubt, some Ichneumon-fly. It has been found in Minnesota, Iowa, Kansas and Missouri, and has destroyed about one per cent. of the eggs.



UNDETERMINED EGG-PARASITE OF R. M. LOCUST.

The following letters refer to this species :

The other day as I was strolling through the fields, I stopped to examine some eggs. I found the ground in spots quite full of white grubs, worms or maggots, whatever they may be called. Many of them were in the egg-pods, busy at work. I collected a few, and sent to you in a small vial by mail for your examination. The ground was high and dry where found.—[From S. D. Payne, Kasota, Le Sueur county, Minn., Sept. 28, 1876.]

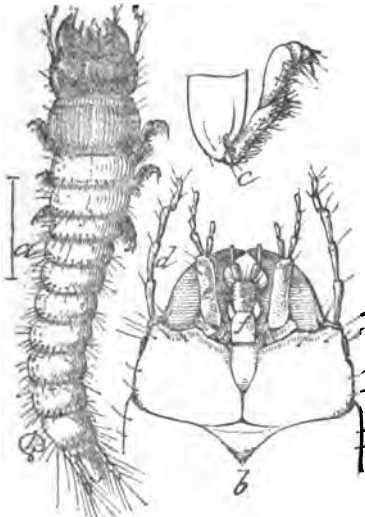
I think the silky mite has done good service in destroying eggs in one or two counties, particularly Noble. But we are getting, in addition, continual newspaper reports of white grubs destroying the eggs. I started out to see for myself, and have found a number which I send you.—[From A. Whitman, St. Paul, Minn., September 7, 1876.]

This grub is found of various sizes as Winter sets in, and hibernates without change. It will doubtless be reared to the perfect state the coming Summer, and I give a more detailed description herewith.

Average length 0.50 inch. Body curved, glabrous, tapering posteriorly, swollen anteriorly. Color opaque whitish, with translucent yellowish mottlings and some vinous marks at sutures, especially along medio-dorsum. Sutures deep. A lateral row of swellings. Head small, flattened, dark-brown, in five pieces, consisting above of a frontal ovoid piece and two lateral pieces of somewhat similar form, and each bearing near tip a minute, 2-jointed palpus; beneath of two broad, sub-triangular jaws having forward and lateral motion, and each also bearing near the center, in a depression, a 2-jointed feeler. A spiracle each side in a fold between joints 2 and 3, and another on each side of the penultimate joint, 12. None otherwise perceptible.

Besides the three preceding species which have been found destroying the eggs the past year, and which, from their being generally

[Fig. 25.]



HARPALUS? LARVA THAT PREYS ON LOCUST EGGS:—a, larva, from above; b, head, from beneath; c, leg—enlarged.

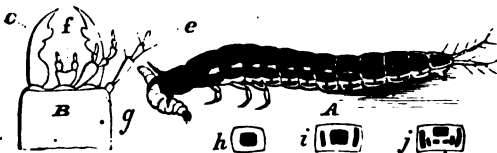
found within the egg-pod, may be called parasitic, though they are not strictly so; I have also found the larvæ of two species of Ground-beetles (*Carabidæ*) attacking said eggs. One pale species, (Fig. 25) evidently belonging to the genus *Harpalus*, is more particularly common and busy in the good work. It is an active creature, something over half an inch long, with powerful jaws and a light brown head and prothorax, and the rest of the body pale, tapering posteriorly and ending in a stout proleg and two articulate appendages. For the entomological reader I append a more detailed description:

Color yellowish white; prothorax and head highly polished yellowish-brown, the jaws darker. Head broad, depressed and rugose in front; jaws broad, robust, dark, and with but one strong middle tooth; antennæ 5-jointed, joints 4 and 5 scarcely equalling 3 in length; maxillæ elongate, subcylindrical, with a 4-jointed outer and a 2-jointed inner palpus; mentum elongate, its base soldered with the lower head; labrum also elongate and with 2-jointed palpi; all trophi armed with stiff hair. Prothoracic joint, swollen, wider than head, twice as long as succeeding joint, horny, and with a darker anterior border, limited by a transverse stria posteriorly and marked with fine longitudinal striæ. Legs, except coxæ, dark brown and thickly beset with short, spinous bristles of the same color. Abdomen tapering to end, with no horny plates, but each joint with two transverse rows of stiff yellowish hairs, the posterior rows strongest. Anal proleg stout, the cerci 4-jointed (joints 3 and 4 small and imperfectly separated) and reaching but little beyond it; eyes small, dark and just behind base of antennæ. Length of largest specimens 0.58 inch.

Eight specimens feeding on eggs of *Caloptenus spretus*.

The other Ground-beetle, belonging probably to the same genus as the above, is of about the same size and has precisely the same structure. It is at once distinguished, however, by a series of broad, dark-brown, horny plates along the back, by paler horny pieces along the

[Fig. 26.]



HARPALUS? LARVA.—B, under-side of head; h, i, j, under-side of different joints of body.

sides and beneath; by the darker, somewhat narrower prothorax; by the pale legs, and by the shorter anal cerci. I have found three specimens of this last feeding on the eggs, and one was sent to

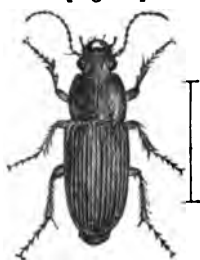
me as having the same habit, by Mr. Whitman, of St. Paul. Mr. G. F. Gaumer has sent me what he took to be a minute Rove-beetle

(*Staphilinidæ*) found feeding on the eggs, and they prove to be newly-hatched specimens of the above *Harpalus* larva.

It is probable that most of the Carabid *arvæ* will feed on the eggs, and I introduce the figure of a larger species (Fig. 26) and its probable parent, the Pennsylvania Ground-beetle (*Harpalus pennsylvanicus* De Geer, Fig. 27).

*Insects which destroy the active Locust.*—In addition to the many animals enumerated in previous reports, which destroy this locust, the Box-turtle may be mentioned, and Mr. Gaumer has found a large burrowing spider (doubtless a *Lycosa* or *Mygale*) to feed upon it. He has also examined several specimens infested with hair-worms, one of which was 18½ inches long. I have myself taken a specimen 6½ inches long, which proves, upon comparison, to be our commonest species,

[Fig. 27.]

PENNSYLVANIA  
GROUND-BEETLE.

*Gordius aquaticus*. Mr. H. A. Brous, who, while in Western Kansas last Summer, made careful notes of everything he observed relating to the Rocky Mountain Locust, has sent me a number of insects found preying upon it that had not before been observed at such work. Among them are various *Asilus*-flies\*, and several Ground-beetles and Tiger-beetles.† More particularly noteworthy among these last is that large and most elegant dark-brown species which I herewith figure (Fig. 29), and which has been

esteemed as a great rarity among Coleopterists. Mr. Brous found it much more common than it was generally supposed, and attributes its

[Fig. 29.]



AMBLYCHILA CYLINDRIFORMIS.

reputed rarity to its secretive and nocturnal habits. It lives in holes in clayey banks, and issues in search of food only at night or early morn. Of Heteroptera, there is a Soldier-lug of the genus *Apiomerus* and allied to *crassipes*; and of Hymenoptera there are two Ichneumons—a *Complex* and *Ephialtes notanda* Cress—that were noticed pursuing the locusts, and are possibly parasitic upon them. The Preying Mantis (*Mantis Carolina*, Rep. 1, p. 169) has been also ob-

[Fig. 28.]



ERAX BASTARDII.

\* *Stenopogon consanguineus* Loew., a species with pale yellowish hairs on head and thorax, yellowish-brown wings and pale rufous legs and abdomen; *Promachus apivora* Fitch; *Erax Bastardii*; several allied species of *Erax*, and a species of *Toimerus*.

† *Pasimachus elongatus* Lec.; *P. punctulatus* Hald.; *Calosoma obsoletum* Say; *Cicindela pulchra* Say; *C. scutellaris* Say; *C. 6-guttata* Fabr.; *C. fulgida* Say; *C. vulgaris* Say; *C. circumpecta* Laf.; *C. formosa* Say; *C. punctulata* Fabr.

served feeding on the locusts by Mr. H. S. King in Texas and by Mr. Brous in Kansas.

EXPERIMENTS WITH THE EGGS, AND CONCLUSIONS DRAWN THEREFROM.

There are many questions respecting the manner in which the eggs of this locust are affected under different conditions, which are of intense practical interest, and which are frequently discussed with no definite result being arrived at, or no positive conclusion drawn. Such are, for instance, the influence of temperature, moisture and dryness upon them; the effects of exposing them to the air, of breaking open the pods, of harrowing or plowing them under at different depths, of tramping upon them. Everything, in short, that may tend to destroy them or prevent the young locusts hatching, is of vital importance. With a view of settling some of these questions, and in the hope of reaching conclusions that might prove valuable, I have carried on, during the past Winter, a series of experiments, some of which are herewith summed up. By reference to the meteorological table given further on, in considering the "Condition of the Eggs," the exact temperature at any of the dates mentioned can be ascertained.

*Experiments to test the Effects of alternately Freezing and Thawing.*

The eggs in the following series of experiments were obtained early in November, at Manhattan, Kans., under similar conditions. They were mostly in a fluid state at the time, and none but good and perfect masses were used. They were all carefully placed in the normal position at the surface of the ground, in boxes that could be easily removed from place to place. The experiments commenced November 10th, 1876, and ended March 10th, 1877. During November and December the weather was severe, while during January and February it was largely mild and genial for the season. In March again there was much frost.

The temperature in my office, into which all the eggs when not exposed were brought, ranged during the day from 65° to 70° F., rarely reaching to 75°. During the night it never dropped below 40°, and averaged about 55°.

*Experiment 1.*—Fifty egg-masses were exposed to frost from November 10th to January 10th, and then taken in-doors. In 20 days they commenced hatching, and continued to do so for 38 days thereafter.

*Experiment 2.*—Fifty egg-masses exposed at the same time to frost. Brought in-doors on December 10th. On December 31st they commenced hatching numerously



and continued to hatch till the 10th of January, 1877, when the remainder were exposed again. The weather being subsequently mild, some hatched on each warm day until the 26th. None hatched thereafter, and upon examination, subsequently, all were found to have hatched.

*Experiment 3.*—Fifty egg-masses exposed at same time. Brought in-doors December 1st. Kept there till the 22d without any of them hatching. Exposed again for three weeks, and then brought in-doors on the 12th of January. They commenced hatching two days thereafter, and continued till the 29th. Subsequent examination showed them all to have hatched.

*Experiment 4.*—One hundred egg-pods exposed at the same time, but alternately brought in-doors and exposed again every 14 days. Some commenced hatching during the second term in-doors; others continued during the warm days of the third exposure, and all had hatched by the sixth day of the third term in-doors.

*Experiment 5.*—A lot of 100 egg-masses alternately exposed and brought in-doors every week. During the first four terms of exposure they were continuously frozen, while during the next four the weather was frequently mild enough to permit hatching. They first began to hatch during the fourth term in-doors, and continued to hatch, except during the colder days when exposed, until the seventh term in-doors, during which the last ones escaped.

*Experiment 6.*—Many hundred egg-masses kept out-doors the whole time, first commenced hatching March 2d.

*Experiment 7.*—Many hundred pods, kept in-doors till December 15, and hatching from November 28th up to that time, were then exposed, and have continued to hatch whenever the weather permitted, and continue to hatch up to the present time (March 10.)

*Experiment 8.*—A lot of 100 pods that had been hatching in-doors from November 19th, were exposed to frost January 15th, and brought in-doors again January 28th, where they continued hatching till February 10th. Every one was subsequently found to have hatched.

*Experiment 9.*—A lot of 100 under same conditions as in experiment 8, up to January 28th. They were then exposed again and brought in-doors February 16th, when they commenced hatching and continued to do so till the 27th. All were found subsequently to have hatched.

Two important conclusions are deducible from the above experiment :

*First*—The eggs are far less susceptible to alternate freezing and thawing than most of us, from analogy, have been inclined to believe. Those who have paid attention to the subject, know full well that the large proportion of insects that hibernate on or in the ground, are more injuriously affected by a mild, alternately freezing and thawing Winter, than by a steadily cold and severe one; and the idea has quite generally prevailed, that it was the same with regard to our locust eggs. But, if so, then it is more owing to the mechanical action which, by alternate expansion and contraction of the soil, heaves the

pods and exposes them, than to the effects of the varying temperatures.

*Second*—That suspended development by frost may continue with impunity for varying periods, after the embryo is fully formed and the young insect is on the verge of hatching. Many persons, having in mind the well known fact that birds' eggs become addled if incubation ceases before completion, when once commenced, would, from analogy, come to the same conclusion with regard to the locust eggs. But analogy here is an unsafe guide. The eggs of insects hibernate in all stages of embryonic development, and many of them with the larva fully formed and complete within. The advanced development of the locust embryo, frequently noticed in the Fall, argues nothing but very early hatching as soon as Spring opens. Their vitality is unimpaired by frost.

*Experiments to test the Influence of Moisture upon the Eggs.*

The following series of experiments were made with eggs also brought from Manhattan, Kansas. They were dug up in December, and were sound, and much in the same condition as those in the preceding series.

The water in all but the last three, or experiments 23, 24 and 25, was kept in my office at the temperature already stated, and only changed when there was the least tendency to become foul. In the alternate submergence and draining, the eggs were submitted to the most severe hygrometric changes; the warm atmosphere of the room having great drying power.

*Experiment 10.*—Ten egg-masses kept under water in-doors from December 5th to December 26th, 1876, the water becoming quite foul. They were then removed to earth and kept in a hatching temperature. They commenced hatching January 11th, 1877, and continued to do so till February 5th—all having hatched.

*Experiment 11.*—Twenty egg-masses kept under water in-doors from December 26th, 1876, till January 2d, 1877; then left dry till the 9th; then submerged again till the 16th, when they were drained again. On the 20th, 18 young hatched, and others continued hatching till the 23d, when they were submerged again. From the 26th to 30th, a few hatched under water, successfully getting rid of the post-natal pellicle, and living for some hours afterward in the water. On the 30th day they were drained again, and continued to hatch. On February 6th, they were again immersed, and continued to hatch on the 7th. On the 15th, 22d, 29th, and March 7th, they were alternately drained and immersed; but none hatched after February 7th, and the remainder proved upon examination to have been destroyed, most of them being quite rotten.

*Experiment 12.*—Two egg-masses taken from the lot in Experiment 11, on February 7th, and placed in moist earth. Every egg subsequently hatched.

*Experiment 13.*—Two egg-masses taken from the lot in Experiment 11, on February 22d, and placed in moist earth. All hatched.

*Experiment 14.*—Twenty egg-masses alternately immersed and drained every two

weeks from December 26th till March 6th. None hatched, but three-fourths of the eggs were at this date sound, the embryo full-formed and active as soon as released, but pale, and evidently too feeble to burst the egg-shell. The rest were killed and more or less decomposed.

*Experiment 15.*—Two egg-masses, after immersion for two weeks, were placed in moist earth. They began hatching 23 days afterward, and continued to do so for 6 days. It was subsequently found that only seven out of forty-eight eggs had collapsed and failed to hatch.

*Experiment 16.*—Two egg-masses immersed for two weeks, and drained for two weeks; then placed in moist earth. Six days afterward they commenced hatching, and continued to do so for 2 days. Subsequently examined, 28 out of 54 eggs had perished.

*Experiment 17.*—Two egg-masses alternately immersed, drained, and immersed again every two weeks, were placed in moist earth. They commenced hatching two days afterward, and continued to do so for 12 days. Upon subsequent examination, 23 out of 52 had perished.

*Experiment 18.*—Twenty egg-masses immersed from Dec. 26, 1876, to Jan. 16, 1877; then drained till Feb. 6th, then immersed till Feb. 27th, then drained again. On Feb. 3d, while dry, they commenced hatching numerously, and a few continued for two days to hatch while immersed. An examination March 7th, showed about half of them still alive, the rest rotten.

*Experiment 19.*—Twenty egg-masses immersed from Dec. 26, 1876, to Jan. 23, 1877; then drained till Feb. 20th, then submerged again. They commenced hatching on the 6th of Feb., and continued two days after the second submergence. On the 7th of March but about 5 per cent. had rotted.

*Experiment 20.*—Two egg-masses immersed for 4 weeks; then drained for 2 weeks; then immersed for one week; then placed in moist earth. They commenced hatching 7 days afterward, and continued to do so for 6 days. Subsequently examined, one of the masses was rotten; the eggs in the other had all hatched.

*Experiment 21.*—Twenty egg-masses kept from Dec. 26th, 1876, in earth saturated with moisture. On Feb. 23d, 1877, they commenced hatching, and continued to do so till March 7th, when all were found to have hatched, except one pod, which was rotten.

*Experiment 22.*—Twenty egg-masses, alternately placed every five days, from Dec. 26, 1876, in earth saturated with moisture and in earth which was very dry. Commenced hatching Feb. 14th, and continued till March 7th, when, upon examination, 9 of the pods were found rotten.

*Experiment 23.*—Twenty egg-masses immersed and exposed out-doors Dec. 26, 1876. From that time till March 7th, the water was frozen and completely thawed at 6 different times, the vessel containing them, which was of glass and admitted the sunlight, several times breaking. The changes were as follows: Frozen till Jan. 10th; then thawed till the 12th; then frozen till the 18th; then thawed till the 20th; then frozen till the 26th; then thawed till Feb. 20th; then partly frozen till the 22d; then thawed till the 26th; then frozen till the 27th; then thawed till March 5th; then frozen. Examined on the 7th of March, one pod only was found rotten; the others apparently sound.

*Experiment 24.*—Two egg-masses under same conditions as in Expt. 23, till Feb. 9th, when they were brought in-doors and placed in earth. One was dried up on the 16th; the other commenced hatching on the 27th, and when examined on March 7th, all the eggs in it were found to have hatched.

*Experiment 25.*—Two egg-masses under same conditions as in Expt. 23, till Feb. 27th, when they were placed in earth in-doors. Those examined March 7th were sound, and near the hatching point.

These experiments, though not yet completed at the time this MS. goes to the printer, yet establish a few facts that were somewhat unexpected. The insect is a denizen of the high and arid regions of the Northwest, and has often been observed to prefer dry and sunny places, and to avoid wet land, for purposes of ovipositing. The belief that moisture was prejudicial to the eggs, has, for these reasons, very generally prevailed. The power which they exhibit of retaining vitality, and of hatching under water or in saturated ground, is, therefore, very remarkable—the more so when viewed in connection with the results obtained in the succeeding experiment. That the eggs should hatch after several weeks submergence, and that the young insect should even throw off the post-natal pellicle, was, to me, quite a surprise, and argues a most wonderful toughness and tenacity. After being dried and soaked for over six weeks, under conditions that approach to those of Spring, I found a good proportion of the eggs to contain the full-formed and living young, which, though somewhat shrunken, and evidently too weak to have made its exit, was still capable of motion. The water evidently retards hatching. An examination of the submerged eggs that remained unhatched long after others had hatched, which had been under similar treatment up to a certain time, and then transferred to earth, showed the jaws and tibial spines to be still quite soft. It is, therefore, in preventing the proper hardening of these delivering points, that water doubtless retards the hatching, and prevents its accomplishment long before the embryo perishes. Yet, when once life has gone, the egg would seem to rot quicker in the water than in the ground.

The results of Experiments 23—25 prove conclusively that water in Winter time, when subject to be frozen, is still less injurious to the eggs.

Altogether, these experiments give us very little encouragement as to the use of water as a destructive agent; and we can readily understand how eggs may hatch out, as they have been known to do, in marshy soil, or soil too wet for the plow; or even from the bottom of ponds that were overflowed during the Winter and Spring. While a certain proportion of the eggs may be destroyed by alternately soaking and drying the soil at short-repeated intervals, it is next to impossible to do this in practice during the Winter season as effectually as it was done in the experiments; and the only case in which water can be profitably used is where the land can be flooded for a few days just at the period when the bulk of the eggs are hatching.

*Experiments to test the Effects of Exposure to the Free Air.*

The eggs in the following series were obtained at Manhattan, Kansas, in November, and all under similar conditions.

*Experiment 26.*—A large number of egg-masses were thoroughly broken up and the single eggs scattered over the surface of the ground out-doors early in December. By the 23d of February all had perished, and most of them had collapsed and shriveled.

*Experiment 27.*—A large number of pods were partly broken up and exposed as in Exp. 26. On the 10th of March the outer eggs were mostly dead and shrunken, but a few of the protected ones were yet plump, the embryo well advanced and apparently sound.

*Experiment 28.*—A large number of unbroken pods were exposed under similar conditions as in the preceding Expts. By March 10th fully three-fourths of the eggs had perished.

*Experiment 29.*—Fifty egg-masses were kept in-doors in an open mouthed bottle in perfectly loose and dry earth from November 6th. Fully 8 per cent. of the eggs had hatched by December 28th, when hatching ceased, and a subsequent examination showed the rest to have shrunken and perished.

It is very evident from the above experiments that we can do much more to destroy the eggs by bringing into requisition the universally utilizable air, than we can by the use of water. The breaking up of the mass and exposure of the individual eggs to the desiccating effects of the atmosphere, effectually destroys them; and when to this is added the well known fact that thus exposed they are more liable to destruction by their numerous enemies, we see at once the importance of this mode of coping with the evil.

*Experiments to test the Effects of burying at different Depths, and of pressing the Soil.*

The following series of experiments were made with eggs obtained at Manhattan, Kansas, early in November, and which were in similar condition to those in the first series. Large tin cylindrical boxes, made of different depths, and varying from 4 to 8 inches in diameter were used; and in order to hasten the result they were kept in-doors at the temperature already mentioned. The soil in all the boxes was finely comminuted and kept in uniform and moderately moist condition. It was gently pressed with the fingers, so as to approach in compactness the surface soil of a well cultivated garden. In each instance the eggs were placed in the centre of the box. A large number of eggs have been buried at different depths out-doors where they are under natural conditions of soil pressure and temperature, and the experiments here recorded were made to anticipate the results in the others, which will not be completed till long after this Report is published.

*Experiment 30.*—Ten egg-masses were placed just one inch below the surface in the centre of a box 4 inches in diameter. The young began to appear January 30th, when it was noticed that every one came up at the side of the box, between the earth and the tin, where there was more or less shrinking of the former from the latter. Upon pressing the earth more firmly around the border, the issuing of the young ceased. Upon examining the eggs March 7th, it was found that they had all hatched. A few of the young were still alive and endeavoring to escape. The rest had died in the effort. They had made no progress upward through the pressed surface, but had pushed horizontally as the looser earth permitted.

*Experiment 31.*—From 10 egg-masses placed 2 inches beneath the surface the young commenced issuing from the sides as in the preceding Exp., Jan. 31st. None issued directly through the surface of the soil, and none issued after the border was pressed more firmly to the tin. Subsequent examination showed the soil penetrated in devious directions, but none of the insects had reached higher than within  $\frac{1}{4}$  inch of the surface.

*Experiment 32.*—Ten egg-masses placed 3 inches below the surface. The young began, Jan. 31st, to issue from the sides as in Expts. 30, 31. Upon pressing the ground more firmly around the borders, none afterward issued, and subsequent examination showed that the young had tunneled the earth in tortuous passages toward the sides, and perished there; without reaching nearer than within an inch of the surface in the middle of the box.

*Experiment 33.*—Ten egg-masses placed 6 inches below the surface. On Feb. 1st the young commenced to issue, as in the preceding Expts., from the side, and continued to do so till the 4th, when the earth was pressed more closely to the tin. None issued afterward. Subsequent examination showed that some had succeeded in working their way upward through the soil to within two inches of the surface; but most had reached the sides and there collected and perished between the tin and the soil.

Other experiments, made in glass tubes where the movements of the insects could be watched, all produced similar results to those above given, and all point to the conclusion that where the newly hatched insect has not the natural channel of exit (described on p. 88) which was prepared by the mother, it must inevitably perish if the soil be moderately compact, unless cracks, fissures, or other channels reaching to the surface, are at hand.

From the above four series of experiments, I would draw the following deductions, which have important practical bearing:

*First*—Frost has no injurious effect on the eggs; its influence is beneficial rather, in weakening the outer shell.

*Second*—Alternately freezing and thawing is far less injurious to them than we have hitherto supposed, and tends to their destruction, if at all, indirectly, by exposing them to the free air.

*Third*—The breaking open of the egg-masses, and exposure of the eggs to the atmosphere, is the most effectual way of destroying them. Hence, the importance of harrowing in the Fall is obvious.

*Fourth*—Moisture has altogether less effect on the vitality of the eggs than has heretofore been supposed, and will be of little use as a

destructive agent, except where land can be overflowed for two or three days at the time when the bulk of the young are hatching.

*Fifth*—Plowing under of the eggs will be effectual in destroying them, just in proportion as the ground is afterward harrowed and rolled. Its effects will also necessarily vary with the nature of the soil. Other things being equal, Fall plowing will have the advantage over Spring plowing, not only in retarding the hatching period, but in permitting the settling and compacting of the soil; while where the ground is afterwards harrowed and rolled, the Spring plowing will prove just as good, and on light soils, perhaps better.

#### THE OMAHA CONFERENCE.

At the invitation of Governor Jno. S. Pillsbury, of Minnesota, a conference of the Executives of those States and Territories which most suffer from locust ravages, and of scientific gentlemen interested in the subject, was held at Omaha, Neb., on the 25th and 26th of October last. The following gentlemen were in attendance :

Prof. Cyrus Thomas, of Illinois.  
Gov. Samuel J. Kirkwood, of Iowa.  
Gov. Thomas A. Osborne, of Kansas.  
Gov. Silas Garber,  
Ex-Gov. Robt. W. Furnas,  
Prof. C. D. Wilber,  
Prof. A. D. Williams, and  
Hon. Geo. W. Frost, of Nebraska.  
Gov. John S. Pillsbury,  
Pennock Pusey, and  
Prof. A. Whitman, of Minnesota.  
Gov. John L. Pennington, of Dakota, and  
Gov. C. H. Hardin, and  
C. V. Riley, of Missouri.

After an interesting and instructive interchange of opinions and experiences, the following resolutions, reported by the writer on behalf of a committee appointed to express the sense of the Conference, were unanimously adopted :

Your Committee, appointed to draft resolutions expressive of the views of the Conference, would respectfully report as follows :

The Rocky Mountain Locust, or "grasshopper," by its migrations from Territory to Territory and from State to State, destroying millions of dollars' worth of the hard earnings of the Western farmers, crippling the progress of the border States, and retarding the settlement of the Territories, has become a national plague. Its injuries are of such magnitude that no effort should be left untried that will be likely to diminish or avert them.

The work to be done is of a two-fold nature—State and National. From the writings of those who have given the subject careful attention, and from our own past experience, it is quite manifest that the pest in question is not a native of the country

south of the 44th parallel or east of the 100th meridian, but that it occasionally overruns the country south and east of these lines, from the extreme Northwest.

There are, therefore, two pressing questions which demand our attention:

1st The best means of fighting the plague as it occurs in the States to which it migrates, but in which it is not indigenous.

2d. The thorough investigation into its habits in its native home, with a view of preventing, if possible, its migrations therefrom.

Toward the elucidation and settlement of the first we have the dear-bought experience of the past few years, and there has already been a large amount of valuable information obtained and published in the proclamation of Gov. Pillsbury, in the report of the special Minnesota commission, appointed in 1875, in the two last entomological reports made to the State of Missouri, by its State entomologist, and in the writings of Prof. Thomas and others. We, therefore, recommend the passage of the following resolutions:

*Resolved*, That, as much valuable and practical advice has already been published a committee of three be appointed to collect and issue in pamphlet form, as soon as possible, all the more practicable means, based on experience, that we now have any knowledge of, toward the destruction of the insect, whether as it pours down upon us in the winged condition, or as it hatches out in our midst.

*Resolved*, That the official report of the proceedings of this Conference shall form the prelude to this pamphlet, and that the following recommendations and statement of our views, as to the possibility of contending with the locust shall form a part of said pamphlet. [Here omitted.]

Further, in order to meet the emergency that threatens next Spring, particular stress should be laid on the best means of coming with the eggs and unfledged young that will hatch from them in the Spring of 1877. Among these, we deem as most feasible and best calculated to produce good results, a judicious bounty system; and, as that recommended by Prof. Riley, in his eighth report, is based on the valuable experience gained in 1875, and correctly states the principles that should govern such legislation, we recommend the following:

*Resolved*, That in our opinion it will be wise and politic for the legislatures of each of the States and Territories most deeply interested in the locust question, to enact a State bounty law, offering a bounty of—per bushel for the collection and destruction of the eggs, and of—per bushel for the destruction of the unfledged insects; that the principles laid down by Prof. Riley for such a law should be kept in view; and that we will use our influence to obtain such a law in our respective States.

*Resolved*, That we recommend to the several legislatures, that they authorize local taxation for the purpose of systematized effort in the way of ditching, burning, etc., as the local authorities may deem necessary or desirable.

We further invoke our legislatures to adopt such practicable measures as have proved efficacious, and such as further experience may suggest, including the repeal of existing game laws, or such modification of them as will prevent the destruction of birds which feed upon the insects; the prevention of prairie fires until suitable time for the destruction of the young locusts by firing the grass; the encouragement of tree culture for promoting moisture and harboring birds, and such other means as may promote the great end desired.

*Resolved, further*, That in view of the danger that threatens, it is advisable that, as far as possible, a survey be made of each State during the coming Winter, to ascertain just those portions of each county in which the eggs are most thickly laid, in order to indicate to the county and State authorities the amount of the preparatory work to be done to prevent the threatened injury, and also in order to more thoroughly organize every portion of each State on some plan of securing the intelligent co-operation of farmers and others.

We also recommend the passage of the following resolution:

*Resolved*, That the Governors of each State and Territory be advised to appoint a commission of one or more competent persons whose duties shall be to visit the counties and towns of each State, and report the facts and observations to the Governors, and also to organize each county and precinct in such manner as may be deemed expedient, and also to appoint in said counties and precincts, suitable persons to receive and distribute such documents and pamphlets, containing general information and means of defence, as will be provided by this Conference, and to report such organizations and names of committees to the respective Governors.

For the solution of the second question, it is the evident duty of the Government to make the proper investigation. We have looked in vain for this aid from our Department of Agriculture, and are satisfied that under its present management, such aid, or any thorough investigations, are not to be expected. We therefore recommend the following:



*Resolved*, That we deem it the duty of the National Government to make some effort to destroy or counteract this great pest, and thus prevent its injuries.

*Resolved*, That we believe the first step in this matter should be a thorough investigation into the history and habits of this insect, in its native haunts as well as in the sections visited by it, and the search for all possible means of its extermination, and remedial agencies which may be used against it.

*Resolved*, That we believe this can be accomplished in the shortest time, at the least expense and most effectually by attaching a special commission for this purpose, to one of the Government Surveys sent out annually to the West; and, therefore, we suggest that the following be added to that clause of the Sundry Civil Appropriation Bill, making an appropriation for the geological and geographical survey of the Territories: "And also the further sum of twenty-five thousand dollars for the purpose of paying the salaries and expenses of a commission to consist of three entomologists and two Western men who have had experience with the locusts, to be appointed by the Chief of said survey, with the consent and approval of the Secretary of the Interior. It shall be the duty of said commissioners to examine into the history and habits of the said locust, and make report thereon, and also suggest such means of destroying them or remedies against them as their investigations shall prove most practicable."

*Resolved*, That it is our belief that the Signal Service might materially aid such a commission as here demanded, in performing the work, by regular observations made of the time, direction, extent of flights, time of hatching and leaving of the young locusts, etc.; also, by announcing in the daily weather reports the appearance and progress of the swarms; and we ask of Congress to grant to Gen. Myer such additional assistance and means as will enable him to carry out this work.

*Resolved*, That the President of the Conference be requested to draw up and present to the President of the United States, a letter setting forth the urgent necessity for some action on the part of the General Government in behalf of the sections ravaged, in reference to the invasions of and destruction occasioned by the locusts.

*Resolved*, That each of the Governors of the following States and Territories, to-wit: Minnesota, Illinois, Iowa, Kansas, Nebraska, Missouri, Colorado, Wyoming, Dakota and Montana, be requested to transmit to their respective delegations a record of these proceedings, requesting them to urge upon Congress speedy action in this matter, in accordance with the recommendations of this Conference.

A committee consisting of John S. Pillsbury, Pennock Pusey, and myself, was appointed to prepare for publication the official report of Proceedings, together with a summary of the best means known for counteracting the evil; and 10,000 copies of a pamphlet of 72 pages were accordingly published last Fall. By being widely distributed, this pamphlet has undoubtedly done much good, and had no small share in bringing about certain much needed State and National legislation.

#### REMEDIES AND SUGGESTIONS.

As the people in the threatened counties already enumerated (*ante*, p. 67) will, in all probability, go through much the same experience this year, that the farmers of the afflicted counties went through in 1875, there will be a large demand for information as to how best to manage and destroy the young insects. In the hope that this Report will be distributed at an early day, I have thought best to repeat here some of the recommendations made in my last Report, and in the Omaha pamphlet.

**DESTRUCTION OF THE YOUNG OR UNFLEDGED LOCUSTS.** — Heavy rolling, where the surface of the soil is sufficiently firm and even, destroys a large number of these

newly hatched young, but is most advantageously employed when they are most sluggish and inclined to huddle together, as during the first eight or ten days after hatching, and in the mornings and evenings subsequently. They then drive almost as readily as sheep, and may be burned in large quantities by being driven into windrows or piles of burning hay or straw. They may also be killed with kerosene, and by means of flattened beating implements; wooden shovels being extensively used for this purpose in Europe.

But to protect the crops and do battle to these young locust armies, especially where, as was the case in much of the ravaged country in 1875, there is little or no hay or straw to burn, the best method is ditching. A ditch two feet wide and two feet deep, with perpendicular sides, offers an effectual barrier to the young insects. They tumble into it and accumulate, and die at the bottom in large quantities. In a few days the stench becomes great, and necessitates the covering up of the mass. In order to keep the main ditch open, therefore, it is best to dig pits or deeper side ditches at short intervals, into which the 'hoppers will accumulate and may be buried. Made around a field about hatching time, few 'hoppers will get into that field till they acquire wings, and by that time the principal danger is over, and the insects are fast disappearing. If any should hatch within the enclosure, they are easily driven into the ditches dug in different parts of the field. The direction of the apprehended approach of the insects being known from their hatching locality, ditching one or two sides next to such locality, is generally sufficient, and where farmers joint they can construct a long ditch, which will protect many farms.

With proper and systematic ditching early in the season, when the insects first hatch, everything can be saved. When water can be let into the ditches so as to cover the bottom they may be made shallower, and still be effective.

A ditch three feet wide, unless correspondingly deep, will be more apt to permit the escape of the insects, when once in, than a narrower one. In hopping, the more perpendicular the direction the insects must take, the shorter will be the distance reached. Of course the wider the ditch, if it be correspondingly deep, the more effectual will it prove. In exceptional cases, when the locusts are nearly full grown and the wind is high so as to assist them, even the two-foot ditch loses much of its value.

Next to ditching the use of nets or seines, or converging strips of calico or any other material, made after the plan of a quail net, has proved most satisfactory. By digging a pit, or boring a post auger hole, three or four feet deep, and then staking the two wings so that they converge toward it, large numbers of the locusts may be driven into the pit after the dew is off the ground. By changing the position of this trap, much good can be done when the insects are yet small and huddled in schools; but all modes of bagging, netting, crushing with the spade or other flat implements and burning, which can be employed to good advantage when the insects first begin to hatch, become comparatively useless when they begin to travel in concert over wide stretches of land. The same may be said of all the mechanical contrivances to facilitate the destruction of the insects; they are useful if used in concert in a given neighborhood soon after the young hatch, but subsequently do not compare to ditching.

When the insects are famishing, it is useless to try and protect plants by any application whatever, though spraying them with a mixture of kerosene and warm water is the best protection yet known, and will measurably answer when the insects are not too numerous or ravenous.

The best means of protecting fruit and shade trees deserves separate consideration. Where the trunk is smooth and perpendicular, they may be protected by whitewashing.

The lime crumbles under the feet of the insects as they attempt to climb, and prevents their getting up. By their persistent efforts, however, they gradually tear off the lime and reach a higher point each day, so that the whitewashing must be often repeated. Trees with short, rough trunks, or which lean, are not very well protected in this way. A strip of smooth, bright tin answers even better for the same purpose. A strip three or four inches wide brought around and tacked to a smooth tree will protect it; while on rougher trees a piece of old rope may first be tacked around the tree and the tin tacked to it, so as to leave a portion both above and below. Passages between the tin and rope or the rope and tree can then be blocked by filling the upper area between tin and tree with earth. The tin must be high enough from the ground to prevent the 'hoppers from jumping from the latter beyond it; and the trunk below the tin, where the insects collect, should be covered with some greasy or poisonous substances to prevent girdling. This is more especially necessary with small trees; and kerosene or whitewash having Paris green mixed with it will answer as such preventives.

One of the cheapest and simplest modes is to encircle the tree with cotton batting, into which the insects will entangle their feet, and thus be more or less obstructed. Strips of paper covered with tar, stiff paper tied on so as to slope roof-fashion, strips of glazed wall paper, thick coatings of soft soap, have been used with varying success; but no estoppel equals the bright tin; the others require constant watching and renewal, and in all cases coming under my observation some insects would get into the trees so as to require the daily shaking of these morning and evening. This will sometimes have to be done when the bulk of the insects have become fledged, even where tin is used; for a certain proportion of the insects will then fly into the trees. They do most damage during the night, and care should be had that the trees be unloaded of their voracious freight just before dark.

Finally, most cultivated plants may be measurably protected from the ravages of these young by good cultivation and a constant stirring of the soil. The young have an antipathy to a loose and friable surface, which incommodes them and hinders their progress; and they will often leave such a surface for one more hard and firm.

Hogs and poultry of every description delight to feed on the young locusts, and will flourish where these abound when nothing else does. Our farmers in the threatened counties should provide themselves with as large a quantity as possible of this stock. Where no general and systematic efforts have been made to destroy either the eggs or the young locusts, and it is found that, as Spring opens, these young hatch out in threatening numbers, the intelligent farmer will delay the planting of everything that cannot be protected by ditching until the very last moment, or till the insects become fledged—using his team and time solely in the preparation of his land. In this way he will not only save his seed and the labor of planting, and, perhaps, replanting, but he will materially assist in weakening the devouring armies. Men planted in 1875, and worked with a will and energy born of necessity, only to see their crops finally taken, their seed gone, and their teams and themselves worn out. The locusts in the end destroyed every green thing, until finding nothing more, they began to fall upon each other and to perish. This critical period in their history would have been brought about much earlier if they had not had the cultivated crops to feed upon; and if by concert of action this system of non-planting could at first have been adopted over large areas, the insects would have been much sooner starved out and obliged to congregate in the pastures, prairies and timber. Moreover the time required for early planting and cultivation, if devoted to destroying the insects after the bulk of them hatch out toward the end of April, would virtually annihilate them.

Too much stress cannot be laid on the advantages of co-operation and concert of

action, to accomplish which ought not to be difficult, with our present Grange system. To insure concert of action, it would be well to authorize the supervisors of each school district to call out every able-bodied man and oblige him to work in a general system of destruction as soon as the bulk of the young insects have hatched, and the same would apply equally as well to the destruction of the eggs.

Many of the wheat fields have been injured principally on the outside. I would recommend to plow up such injured portions and sow to rye. Finally, though insisting on ditching and the digging of pits, as, all things considered, the best and most reliable insurance against the ravages of the young locusts; I would urge our farmers to rely not on this means alone, but to employ all the other means recommended, according as convenience and opportunity suggest.

#### LEGISLATION.

It is a gratifying indication of the increasing appreciation of economic entomology that, while three years ago the mere suggestion to enact laws for the suppression of injurious insects would have been, and was received by our legislators with ridicule; yet, during the Winter of 1876-7, several States have seen fit to pass acts that have for object the destruction of this locust, or the relief of the suffering and destitution it so often entails. Even Congress has at last felt the necessity of doing something to mitigate this national evil, and at the last hour, made an appropriation to defray the expenses of a commission, whose duty it shall be to make a thorough investigation into the matter. I give below the State laws that have been passed:

#### MISSOURI.—AN ACT TO ENCOURAGE THE DESTRUCTION OF GRASSHOPPERS.

*Be it enacted by the General Assembly of the State of Missouri, as follows:*

SECTION 1. Any person who shall gather, or cause to be gathered by any person in his employ, eggs of the Rocky Mountain locust or grasshopper, at any time after they are deposited in the earth in the autumn of any year, and before they are hatched the following spring, shall be entitled to a bounty of five dollars for each and every bushel of eggs thus gathered, or for any quantity less than one bushel, bounty at the same rate, to be paid, one-half by the State and one-half by the county in which they are gathered.

SEC. 2. Any person who shall gather, collect and kill, or cause to be so collected and killed, young and unfledged grasshoppers in the month of March, shall be entitled to a bounty of one dollar for each bushel, and for the month of April, fifty cents per bushel, and for the month of May, twenty-five cents per bushel, to be paid in the same manner as in the preceding section.

SEC. 3. Any person claiming bounty under this act, shall produce the eggs and grasshoppers thus gathered or killed, as the case may be, before the clerk of the county court in which such eggs or grasshoppers were gathered or killed, within ten days thereafter, whereupon said clerk shall administer to such person the following oath or affirmation: You do solemnly swear (or affirm, as the case may be,) that the eggs (or grasshoppers, as the case may be,) produced by you, were taken and gathered by you, or by person or persons in your employ, or under your control, and within this county and State.

SEC. 4. The clerk shall forthwith destroy said eggs by burning the same and give to the person proving up the same under his hand and seal, a certificate setting forth in a plain handwriting, without interlineation, the amount of eggs or grasshoppers pro-

duced and destroyed by him, and the name and residence of such person producing the same, which certificate shall be in the following form :

STATE OF MISSOURI, }  
COUNTY OF..... }

This is to certify that ..... in the county of ..... A. B., did this day prove before me that he had gathered, or caused to be gathered, ..... of eggs, ..... grasshoppers, and is entitled to the sum of ..... dollars, and ..... cents.

Given under my hand and seal of my office, this ..... day of ..... A. D 18.....

..... A. B., Clerk County Court.

Which certificate shall be received and taken by the collector of revenue of the county in which the same was given, and such collector shall be allowed pay out of the county and State Treasury, one-half from each.

SEC. 5. Such clerk shall keep a register of all such certificates given by him, in a book which he shall keep for that purpose, in which he shall note down every certificate granted by him, the number and amount, and to whom granted, and transmit a certified copy of such register, under the seal of the court, to the Treasurer of the State, who shall not allow and pay any certificate, which does not correspond with such register.

SEC. 6. Such clerk shall receive for his services as aforesaid, one dollar for such certified copy of the register, and the regular fee for the certificate and seal, and ten cents for each certificate granted under this act, all to be paid out of the treasury of his county.

SEC. 7. As the object of this act is the rapid destruction of the locust the ensuing spring, it shall take effect and be in force from and after its passage.

Approved February 23, 1877.

This act is drawn up after the form recommended in my last Report, and reprinted in the Omaha pamphlet. Section 3, requiring persons claiming bounty, to carry from all parts of the county, the eggs or young insects collected, is defective, as those living near the county seat will have most advantage and inducement. It would be better, as I suggested years ago, to empower the Township Trustee, or the Street Commissioner, to receive and measure the eggs or young insects, and to issue certificates setting forth the number of bushels destroyed—the certificates to be filed with the County Clerk. But even with this slight defect, the act will have a beneficial effect in the counties subject to locust ravages :

#### KANSAS—AN ACT TO PROVIDE FOR THE DESTRUCTION OF GRASSHOPPERS AND TO PUNISH FOR VIOLATION OF THIS ACT.

*Be it enacted by the Legislature of the State of Kansas :*

SECTION 1. That the township trustees of the different townships, and the mayors of cities which are not included in any township of any county within this State, are hereby authorized and it is made their duty, when so requested, in writing, by fifteen of the legal voters of the township or city, to issue orders to the road overseers of the different road districts within their respective townships or cities, to warn out all able bodied males between the ages of twelve and fifty years within their respective districts for the purpose of destroying locusts or migratory insects.

SEC. 2. It shall be the duty of road overseers, immediately after receiving said orders, to proceed at once to warn out all persons liable under section one of this act, giving notice of the time and place of meeting, and the tools to be used, and the kind of work expected to be performed, and all work shall be done and performed under the direction of the road overseers.

SEC. 3. Any persons over eighteen years of age warned out as is provided in this act, may pay the road overseer the sum of one dollar per day for the time so warned out, and in case any persons shall fail to perform labor under this act or paying the sum of one dollar when so warned out, shall be adjudged guilty of a misdemeanor, and on conviction, shall be fined the sum of three dollars for each day so failing or

refusing, and the moneys so collected shall be expended by the road overseer in the destruction of grasshoppers in their respective road districts.

SEC. 4. For the purpose of carrying out the provisions of this act the road overseer is authorized to enter upon the premises of any person lying within the township where such order of the township trustee is in force, with a sufficient number of hands and teams to perform such labor as he may deem necessary for the public good.

SEC. 5. It shall be the duty of the Secretary of the State Board of Agriculture, immediately after the passage of this act, to compile in circular form all information relating to the manner and means heretofore used for the extermination of grasshoppers, and send at least ten copies of the same to each township trustee in the State.

SEC. 6. This act shall take effect and be in force from and after its publication once in the Commonwealth.

Approved March 6, 1877.

**AN ACT PROVIDING FOR A CONCERT OF ACTION BY SENATORIAL DISTRICTS FOR THE DESTRUCTION OF GRASSHOPPERS.**

*Be it enacted by the Legislature of the State of Kansas :*

SECTION 1. That in any senatorial district in the State of Kansas, where trouble is anticipated from the ravages of young grasshoppers, in the year 1877, and any subsequent year thereafter, it shall be lawful for the counties in said senatorial district to co-operate together in the way and manner herein provided, for the destruction of the same.

SEC. 2. The chairman of the board of county commissioners in the county having the largest number of inhabitants in a senatorial district, where two or more counties form said district, may notify the chairman of each of the boards of county commissioners of the remaining counties in said district, of the time and place when the chairman of the several boards of commissioners of the respective counties forming said senatorial district shall hold a joint meeting.

SEC. 3. At such meeting two of their number shall be chosen to act as chairman and secretary, and the proceedings of the meeting shall be published in all the newspapers printed in the senatorial district.

SEC. 4. Said meeting shall designate the manner of procedure by road overseers, and what day or days the young grasshoppers should be driven from the cultivated land on the unburnt prairie or places of destruction, and shall also designate on what day or days the grasshoppers shall be destroyed, by burning or otherwise, in said senatorial district, giving at least ten days' notice of the same by publishing in the newspapers of the said district.

SEC. 5. The board of commissioners of each county shall notify the road overseers of said county of the time fixed upon by the joint meeting for the driving and burning, or destroying by other means, of the grasshoppers in the district; said notice to be given to said overseers as soon as practicable after the same shall have been determined by the joint meeting.

SEC. 6. Said road overseer shall immediately notify the residents of his road district of the time designated and the manner of procedure, in order to carry out the provisions of this act. He shall also specify what tools or implements will be required of each resident in performing the labor required of him; and such notice may be enforced the same as in the acts authorizing road overseers to warn out the residents to perform road labor; and a refusal shall subject such persons refusing to the same penalties as are provided by law in such cases.

SEC. 7. The road overseers shall direct the manner of performing the labor, and have the supervision of the same, and shall keep a list of the names of those who shall perform labor, and shall certify the number of days' work performed by each, and shall place such certified list in the possession of the board of county commissioners of his county.

SEC. 8. It shall be lawful for two or more senatorial districts to co-operate together under the provisions of this act, on a basis of action which they may agree upon.

SEC. 9. This act shall take effect and be in force from and after its publication in the daily *Commonwealth*.

Approved March 7, 1877.

Both these acts look to compulsory work and concert of action, and in these respects are preferable to bounty acts, and will, without doubt, be productive of more good to the community at less expense to the State. The objects of the two acts should, I think, have been combined in one.

**MINNESOTA.—AN ACT TO PROVIDE FOR THE DESTRUCTION OF GRASSHOPPERS AND THEIR EGGS.**

*Be it enacted by the Legislature of the State of Minnesota :*

**SECTION 1.** There shall be paid by this State, out of any moneys in the treasury thereof, not otherwise appropriated, to any person or persons living within any of the counties in said State afflicted by grasshoppers, the following bounties for catching and destroying of the same, and the destruction of their eggs.

**SEC. 2.** The sum of one dollar per bushel for grasshoppers caught previous to the twenty-fifth day of May next. The sum of fifty cents per bushel from the said twenty-fifth day of May to the tenth day of June. The sum of twenty-five cents per bushel from the said tenth day of June to the first day of July, and twenty cents per bushel from the said first day of July to the first day of October next.

**SEC. 3.** There shall also be paid in the same manner, the sum of fifty cents per gallon for any and all grasshopper eggs taken and destroyed by any person or persons.

**SEC. 4.** There shall be appointed by the Governor a competent person in each township in the several counties so afflicted by grasshoppers, who shall be a resident of the township for which he shall be appointed, to receive, measure and destroy the grasshoppers and their eggs delivered to him by any person or persons catching and taking the same, which said person so appointed shall take and subscribe an oath for the faithful discharge of his duties, which oath, together with the certificate of appointment, shall be filed in the office of the county auditor, and he shall receive as compensation for his services such sum as the county commissioner may determine, to be paid out of the funds of the county, and in case of necessity, when he cannot perform the duties of his office, said measurer shall have authority and be empowered to appoint a suitable and competent person his assistant, which assistant shall be required to take and subscribe the same oath and be subject to the same penalties as the said measurer.

**SEC. 5.** The person receiving and measuring the grasshoppers and their eggs as aforesaid, shall measure and immediately and effectually destroy the same, and keep an exact account of all the grasshoppers and their eggs received by him and the names of the persons delivering the same, and shall issue a certificate for the amount of grasshoppers and their eggs to the person delivering the same. And he shall, at the end of each week after commencing to receive and measure the same, and on the second day of June, on the eleventh day of said month, on the second day of July, and on the second day of October next, make a report to the county auditor of all the grasshoppers and their eggs measured by him, the number of certificates issued, and the names of the persons to whom he issued the same; and the county auditor shall examine the same and file it in his office, which report shall be subject to public inspection; and the county auditor shall, at the end of each week after he shall have received the first of said reports, transmit a copy of the said reports, to the Governor, who shall, as soon as the sum hereby appropriated shall have been expended in the payment of said bounties, notify all persons interested therein of such fact by a publication of such notice in some newspaper printed and published at the city of Saint Paul, in said State of Minnesota, for three successive days.

**SEC. 6.** For a failure on the part of said measurer to perform any of his duties under this act, or for any mismeasurement of such grasshoppers and their eggs, he shall be deemed to be guilty of a misdemeanor, and be subject to pay a fine of not less than ten dollars nor more than one hundred dollars, or be imprisoned in the county jail for a term of not less than thirty nor more than ninety days, in a suit or proceeding to be prosecuted in the name of the State of Minnesota, in the same manner as is provided by law in other cases of misdemeanor.

**SEC. 7.** Upon the presentation of such certificate to the county auditor, he shall issue a certificate to the person entitled thereto for the amount due him, (a form of which certificate shall be furnished by the State Auditor,) and shall make an order upon the State Auditor for the amount thereof, and the State Auditor shall draw his warrant upon the State Treasurer for that amount, in favor of the parties holding said certificates, which shall be paid by the State Treasurer on presentation: *Provided*, That all certificates presented to the county auditor for payment shall be by him filed and preserved in his office, and he shall present such certificates to the board of county commissioners, who shall audit the same in the manner now provided by law for auditing accounts against counties; and no money shall be drawn from the State treasury until such certificates have been audited and allowed in the manner herein provided. And that no money shall be paid under the provisions of this act at any time prior to the fifteenth day of July, A. D. eighteen hundred and seventy-seven, and that the money hereby appropriated shall only apply to certificates duly made and filed with the Auditor of State on or before said day; that at the time after the State Auditor shall ascertain the total amount of all claims and certificates so filed, and if the same

shall exceed in amount the sum of one hundred thousand dollars, then the said claims shall be paid pro rata, and no other or greater amount than said sum of one hundred thousand dollars shall ever be paid under the provisions of this act: *And provided further*, That if the amount hereby appropriated is not sufficient to pay the certificates in full, the balance shall be paid by the counties respectively, according to the amount due on said certificates as issued by such county.

SEC. 8. Every male inhabitant of the several townships in the said afflicted counties, being above the age of twenty-one years and under the age of sixty years, excepting paupers, idiots and lunatics, shall be assessed by the board of supervisors of said township to work one day in each week in said township, during the period hereinafter mentioned, for the paying of bounties for the purpose of catching and destroying grasshoppers and their eggs, for five weeks from the time said grasshoppers shall become large enough to be taken; and the amount of work to be so assessed shall not exceed five days in all.

SEC. 9. The supervisors aforesaid shall make a list of the names of all persons against whom said tax shall have been assessed, and place in a column opposite each name on said list, the amount of labor assessed against such person, and shall direct the town clerk to make a certified copy of each list, after which the town clerk shall deliver the several copies to the respective overseers of the highways of said townships.

SEC. 10. The overseers of highways shall give at least two days' notice to all persons assessed to work as aforesaid, living within the limits of their respective districts, of the time and places where and when they are to appear for that purpose, and with what implements.

SEC. 11. Every person liable to work, as provided for in this act, may commute for the same at the rate of one dollar per day, in which case such commutation money shall be paid to the chairman of the board of supervisors, to be applied and expended by him for the destruction of grasshoppers and their eggs, and he shall be authorized and required to hire and engage some suitable and efficient person to work in the place of said person so commuting, and to pay them the sum of one dollar per day for his services; and every person intending to commute for his assessment shall, within five days after he is notified to appear and work as aforesaid, pay the commutation money for the work required of him by said notice, and the commutation shall not be considered as made until such money is paid.

SEC. 12. Every person so assessed and notified, who shall willfully neglect or refuse to commute or work as provided by this act, shall be guilty of a misdemeanor, and shall, on conviction thereof, be liable to pay a fine of not less than two dollars nor more than ten dollars, or by imprisonment in the county jail not more than ten days, or both, in the discretion of the court, in a suit to be prosecuted in the name of the State of Minnesota, in the same manner as is provided by law for prosecutions of misdemeanors.

SEC. 13. There shall be appropriated, out of any moneys in the treasury of this State, not otherwise appropriated, for the purpose of carrying out the provisions of this act, the sum of one hundred thousand dollars.

SEC. 14. The board of county commissioners of any county in this State afflicted by grasshoppers, shall have the right, if, in their judgment they see fit, to employ one or more persons in each township in said county with such implements or mechanical contrivances as may prove most efficient to destroy the grasshoppers, from the first day of April to the first day of August in each year, paying such persons either by the day or a specified sum for the amount captured and destroyed. The compensation of such person shall be paid out of the general fund of the county: *Provided further*, That parties employed and paid by the county commissioners shall not receive any other or further compensation under the provisions of this act.

SEC. 15. This act shall take effect and be in force from and after its passage.

Approved March 1, 1877.

More complicated than the others, this Minnesota act has certain special features which are intended to meet the peculiar emergency in that State. Yet I do not think the act is as clear or will prove as effectual as the first Kansas act. In addition to this bounty act, the Minnesota Legislature passed another appropriating \$75,000 for the purchase and distribution of seed grain to the sufferers from locust injuries.



If the States of Iowa, Nebraska, Colorado and Texas would enact similar laws, appropriate to their respective requirements, there would be such combined slaughter of the insects that in all the more thickly settled portions of the country subject to invasion, they would be virtually annihilated before they acquired wings. It is by some such uniform and concerted warfare, calculated to prevent the insects that hatch out in said country from flying back to restock the Northwest, that the people may hope to measurably conquer the foe and lengthen the periods of immunity between the invasions.

#### AREA IN WHICH EGGS WERE LAID.

The locust invasion of 1876 was remarkable for the very large area in which eggs were laid. This was almost coextensive with the area invaded and is indicated in the map (Fig. 16), though the counties of Murray, Cottonwood, Watonwa, Brown and parts of the adjacent counties, in Minnesota, which are there included, should, as already stated (*ante*, p. 62) be excepted.

The eggs are most thickly laid in the eastern, more settled and more generally cultivated portion of the belt, and less thickly in the thinly settled prairie country. Another noticeable feature of this invasion was, that, from Minnesota to the Gulf, egg-laying continued till the females were buried in the first snows or killed by the first severe frosts. Far into November and after the thermometer had frequently fallen several degrees below the freezing point, I found them rousing from the night's benumbing cold, and, under the increasing warmth of the sun toward noon, laying in exposed and sunny places. Hiding in the dry grass or under other shelter where they were unseen during the cooler parts of the day, one might pass through a country at such hours without suspecting their presence; while at noon they would start at every foot step. And only the day before the last one was buried beyond recovery by a severe snow storm, I found females not only laying, but many of them having eggs in the ovaries that were yet quite small—thus showing that they prematurely perished by winter's chilling blasts.

#### CONDITION OF THE EGGS.

The farmers of the West have been deeply interested in the condition of the eggs during the Winter, and have naturally hoped that, as the season advanced, the vitality of these eggs might in some way or other be impaired. I have, from time to time, examined eggs from many different localities, and the following inquiries, with my answers, as published in the *Rural World* at the time, will serve to indicate the generally sound condition they were in, up to the first week in February.

I send you, by to-day's mail, specimens of grasshopper eggs procured on my farm, as follows: Specimen No. 1 was procured in house yard, where exposed to constant tramping; No. 2 from loose soil, in an exposed position; No. 3 from a foot-path, on south side of hedge. Please examine and report upon condition of the several specimens, and oblige.

DR. W. F. RUTBOTTOM.

RHEA'S MILL, COLLIN CO., TEXAS, January 16.

All three lots were sound, and the embryo so far advanced that a week's mild weather would hatch the young.—[Since this was written they have all hatched.]

I have for sometime past been carefully examining the deposits of locust eggs in this vicinity, and find them nearly addled, very few indeed being found, and those only upon sod, in which segmentation cannot be detected with the aid of a small magnifying glass. Other observers here report the same condition, and we are satisfied that no fears need be entertained of damage from the young brood, provided the addled eggs do not hatch. Can the development within the egg be arrested, and yet go on upon the return of proper conditions? Some of us have been led to fear that such might be the case, by the plump, fresh appearance of the little rascals, after repeated freezing and thawing. Your answer to the above question will be thankfully received by many of us here, who depend upon our farm crops for a living.

A. ROBERTS.

LINCOLN, NEBRASKA, January 13, 1877.

It is difficult to get at what Mr. Roberts exactly means. Eggs once "addled" of course never hatch, but "segmentation" does not indicate an addled condition. On the contrary, it indicates development. The best way to get positive information is to send me specimens.

Herein find eggs of Rocky Mountain Locust. What is their condition?

LAMAR, Barton county, Mo.

A. A. DYE.

The eggs are below the average size, and part of them dead. The probabilities are that few of them will hatch.

I am very much interested in this "hopper question," as great quantities of eggs were deposited in this section last Fall. I have read carefully the proceedings of the Conference in Omaha. Also, some of your articles in the *New York Tribune*; but find nothing on the point of what advancement the eggs make towards hatching in the Fall. Of all the egg sacks examined (which were not addled), the eye of the hopper could be discerned through his particular covering; and, on removing the covering, the hind legs could be raised clear of the body, by the aid of a pin. The question is, after making that advancement, will they live through the Winter and hatch out in the Spring?

S. C. BASSETT.

GIBBON, NEB., January 10, 1877.

Yes! I have had them in that advanced condition; kept them till the first of the year; then brought them into a hatching temperature, and they hatched.

I have just been reading the report of your meeting at Omaha, on the grasshopper, and as I live in this great grasshopper country, and am a firm believer in your treatise and sayings on the pest, I have some questions to ask. I made some observations last Fall, and up to the time the ground froze up, of their eggs; and would ask, if young eggs will hatch that were so far advanced that, in breaking open the egg-sack, you could distinguish the hopper's eyes and the shape of his legs? Now, it seems to me, that eggs that far advanced must certainly be destroyed by the cold weather we have had of late. Am I correct? By answering this, you will confer a favor upon one who is greatly interested. It is the prevailing opinion of most of the people that we won't be hurt much in the Spring. Thus far there has been very little prairie burned, and am in hopes by your advice and others, who understand the nature of the hopper, to give them a warm reception in the Spring, if they hatch to any great number.

MINNEAPOLIS, Ottawa county, Kansas.

M. A. ARNOTT.

I would not dare to give hope without examining specimens. Send some along. Little hope can be built on the advanced condition of the eggs. Better prepare to give the young fellows a warm reception in Spring.

I have sent you by mail to-day some hopper eggs, taken out of the ground on December 25. They have been in my store ever since. I have some eggs that have never been outside my store since September, and also some taken out of the ground the same day that the ones I send you were. I am watching them as closely as I can.

WM. C. RALLS.

LE SEUER, Minn.

The eggs are very small, as the pods also, and fully one-half of the eggs are added.

I wish your opinion in relation to a question under discussion here, viz: Will the grasshoppers, that are now in a fleshy or larval state, hatch? The eggs that were laid during the earlier part of the season that the 'hoppers were here, have developed into a larval state, and many persons claim that, because of that development, they will perish by the Winter. My opinion is, that they are all right and will hatch. What do you say. The later laid eggs are yet in a fluid state.

COUNCIL BLUFFS, Iowa.

H. C. RAYMOND.

I am, as will be seen above, of your opinion.

I have to-day been examining grasshopper eggs, and where they are thickest I have found worms or larvæ like the enclosed. Are they the white worms that were in the egg cocoons last Fall, or are they something else? The grasshopper eggs seem in good condition; but we are having very warm weather now, and the frost is coming out of the ground. The weather is much like that we had in '67-8. I found no worms in the cocoons with the eggs.

WM. DUNN.

SYRACUSE, Otoe county, Neb., Feb. 1, 1877.

The locust eggs are yet sound, but I have some hope that the recent very warm weather, if succeeded by severe cold, will cause the death of a large portion. [The grubs preying on the eggs were the *Ichneumon* larva described on p. 96, Fig. 24].

Friend Clarkson, agricultural editor of the *Iowa State Register*, recommends that grasshopper eggs be sent you for examination, and I send by mail to-day, in a tin box, some eggs which have been taken from the ground under the following conditions: As you will find, I have packed them in layers in the box, with paper between. The top layer was taken from black loam on a piece of ground apt to keep dry—that is, well drained—and have never been completely thawed since frozen in the beginning of Winter. The middle layer was taken from sand, and has repeatedly been frozen and thawed out—the water from thawing snow running over and completely saturating the sand daily for some days. The bottom layer is from low land, which was submerged in five feet of water for ten days after they were deposited in the Fall, the ground remaining muddy till frozen, afterwards covered with snow; the continued thawing and evaporation of the last few days have removed the snow and left the surface for two inches in depth thawed and dry. For the past few days we have had it warm in day time, but freezing at night. The place is in Adams county, ninety miles east of Council Bluffs, and forty miles north of the Missouri line.

WM. THOMPSON.

MT. ETNA, Adams County, Iowa, January 30, 1877.

The eggs from all three of the different positions are so little advanced in development that it is impossible to say positively that they are all sound. The liquids have scarcely begun to thicken. So far as I feel warranted in giving an opinion, I should say that they are all sound—those of the third batch only, giving some evidence of injury by the weakening of the integument. [All hatched since.]

By this mail I forward to you one box of the grasshopper eggs. Are they in a good state of preservation, and will they hatch in the Spring if everything hereafter is favorable?

Enclosed I hand you an extract from the *Interior*. You will see the question raised there as to whether an egg can be partially hatched, as these are, and then the process delayed for a long time, and afterwards resume the work and go on to completion. All our people here regard this proposition with considerable doubt. In fact, they deny that such a thing can be done. I should infer that you hold that these eggs will hatch, notwithstanding the interruption. Will you please enlighten us fully as to why this is thus?

HUTCHINSON, KANSAS, January 29, 1877.

J. B. SHANE.

The article alluded to by Mr. Shane closes with the following editorial remarks:

Without arrogating to ourself any special wisdom on the subject, but reasoning from analogy only, should decide that in the case of the eggs referred to by Major Shane—and in fact, all the eggs in the country in the same condition—incubation has been arrested, and that once arrested, it has ceased forever. In all life that emanates from an egg (and what life does not, except the vegetable?) when its development is arrested during incubation, it is a permanent paralysis; in other words, it is death. We say that, analogically, this should be so, but we may be wrong.

The advanced development of the locust embryo in the eggs sent by Mr. Shane, argues nothing but very early hatching as soon as Spring opens. Their vitality is unimpaired, as Mr. Shane may soon prove by bringing them into a warm room. I have had such forward eggs hatch the present Winter after various periods of freezing.

Enclosed, please find eggs of Rocky Mountain Locust. They were taken on my farm, on southeast quarter of section 19, township 28, range 27, county of Lawrence, and State of Missouri.

February 2, 1877.

W. R. GOODMAN.

Fully ten per cent. of the eggs are dead and more or less decomposed. As in other instances from Missouri, a number of the masses, as also the eggs, are far below the average size, and, compared with those received from the farther West and South, are evidently lacking in vitality. They were doubtless the last eggs laid, just before Winter, and when the insects were nearly exhausted.

I, like many others, desiring some information regarding our coming crop of *Grasshoppers*, wish to ask a few questions on the subject. In examining the eggs late last Fall, I found many formed so one could see the eggs and form, and upon recently examining them, I find they are in the same condition as three months ago. Now, will those thus formed pass through the winter and hatch in the Spring, or will they be destroyed? Other eggs are in the same state, for all I can see, as when deposited. Now, is it likely the whole crop will mature in the Spring? Please inform me regarding it. Any information you can give on the subject will be thankfully received by myself and many others, who feel afraid of the results of the coming Spring, with the great amount of eggs deposited.

PLYMOUTH, Nebr., Jan. 21, 1877.

J. E. ROE.

There is no doubt but that the eggs will mature under ordinary Spring conditions. The fact of some of them being so much more advanced than others, will not, in the least, interfere with their hatching.

I send you this day a box of locust eggs packed in earth. Please tell us whether they will hatch?

WICHITA, Kans., Feb. 2, 1877.

A. B. ARMENT.

The eggs were all sound and yet in the fluid state.

Eggs received and examined almost every day during February and up to March 10th, were, like those examined earlier in the season, in the main sound. A certain proportion of the young hatched during the mild Fall weather we had in October, while the unusually warm weather that occurred the last ten days of January and forepart of February caused still larger numbers to hatch, not alone in the southern portion of the territory occupied, but even as far north as Dakota. The young that thus prematurely hatched perished by subsequent frosts, for I have proved that while the eggs are unaffected by intense freezing, the young insects are killed at 15° F. As the Winter was in some respects remarkable, as well for the warm weather which thus caused the eggs to hatch, as for the many and sudden changes of temperature; and as the eggs have not been injured thereby to any appreciable extent up to the date of this writing, I will place upon record, in this connection, the thermometrical observations made at St. Louis from November 15, 1876, to March 10, 1877:

*Temperature at St. Louis, Mo., of Winter of 1876-7.*

1876.	Max.	Min.	Mean.	1877.	Max.	Min.	Mean.
November 15.....	41	30	37	January 11.....	52	32	40
16.....	44	35	39	12.....	32	14	19
17.....	47	40	44	13.....	27	10	22
18.....	47	25	34	14.....	34	23	31
19.....	38	22	32	15.....	43	28	33
20.....	45	31	38	16.....	23	9	18
21.....	47	32	37	17.....	40	20	35
22.....	42	23	35	18.....	46	35	42
23.....	45	31	38	19.....	50	39	45
24.....	51	32	41	20.....	46	21	22
25.....	47	31	40	21.....	37	19	32
26.....	38	30	34	22.....	37	23	26
27.....	45	31	38	23.....	32	10	24
28.....	39	23	28	24.....	31	19	26
29.....	33	27	29	25.....	48	22	36
30.....	27	15	16	26.....	51	32	39
December 1.....	20	4	14	27.....	50	31	41
2.....	24	5	16	28.....	57	33	47
3.....	29	12	23	29.....	57	38	49
4.....	34	24	30	30.....	65	48	57
5.....	45	24	34	31.....	66	53	59
6.....	47	33	38	February 1.....	69	50	59
7.....	47	31	39	2.....	56	44	49
8.....	40	3	15	3.....	48	35	37
9.....	11	-5	5	4.....	46	32	39
10.....	37	9	31	5.....	40	28	33
11.....	55	28	44	6.....	49	34	41
12.....	60	36	48	7.....	53	38	46
13.....	60	38	42	8.....	47	36	42
14.....	38	18	27	9.....	50	33	44
15.....	45	12	36	10.....	58	37	48
16.....	44	4	12	11.....	58	42	52
17.....	27	13	20	12.....	52	29	32
18.....	22	2	16	13.....	36	28	33
19.....	37	18	28	14.....	44	30	38
20.....	43	23	33	15.....	53	31	44
21.....	43	23	34	16.....	47	38	40
22.....	37	20	26	17.....	50	34	42
23.....	24	13	19	18.....	66	34	58
24.....	19	11	15	19.....	58	34	37
25.....	21	13	18	20.....	48	27	39
26.....	21	13	18	21.....	65	34	51
27.....	24	15	21	22.....	53	44	47
28.....	26	17	21	23.....	44	33	38
29.....	19	10	14	24.....	35	29	32
30.....	21	4	15	25.....	33	28	31
31.....	34	17	24	26.....	43	28	37
1877.				27.....	48	23	40
January 1.....	24	13	14	28.....	50	32	43
2.....	21	8	15	March 1.....	47	39	43
3.....	26	11	21	2.....	47	37	39
4.....	42	19	33	3.....	49	18	29
5.....	42	29	36	4.....	32	14	26
6.....	43	32	37	5.....	40	26	34
7.....	35	13	21	6.....	55	30	46
8.....	13	-4	7	7.....	57	36	47
9.....	28	1	19	8.....	55	18	23
10.....	35	21	31	9.....	23	9	18
				10.....	41	16	31

From meteorological data obtained at Lawrence, Kansas, and furnished by Prof. F. H. Snow, and from reports from many other parts of the country, it is evident that the high temperature of January and February was general throughout the country between the Rocky Mountains and the Mississippi, reaching its acme on the 18th of the latter month. Dr. Engelmann found the first maple in bloom, in St. Louis, on the 19th of February, and has no notes of such early blooming in the past forty years during which he has recorded observations.

#### PROSPECTS FOR 1877.

A large number of the readers of this Report would feel sadly disappointed were I to conclude this review of our last locust invasion without expressing an opinion as to the future prospects. To give an opinion as to the happenings of the future is somewhat hazardous where there are so many possible contingencies that are altogether beyond man's ken; yet one who is careful in his expressions and statements need never hesitate to advance them. With a reputation at stake, I have not hesitated to do so in the past, and wherever I have felt warranted in making a positive prediction, or in giving an unqualified opinion, subsequent events have justified the same. I will, therefore, give my views of the prospects for the year 1877, as they appear from the condition of things at this writing (March 10th); premising only that, in forecasting future events in connection with this insect, I would rather err on the bright than the gloomy side.

The area over which eggs have been laid is, as we have already seen, unusually large. It was quite generally noticed that the females were less particular than is their wont in choosing clear and sunny spots for purposes of oviposition, and, after careful consideration of the subject, I should say that, at the lowest estimate, two out of every one hundred acres throughout the area indicated by the heavier lines in my map (Fig. 16) are thickly supplied with eggs, and by this I mean mean that the eggs will average 3,000 to the square foot. In other words, throughout this whole country the southern slopes, sandy, gravelly, and other bare spots, roads, paths, etc., in which the females prefer to lay; compare, on an average, as 2 to 100 with the northern slopes, timber, rank prairie, moist and recently cultivated lands, which are generally avoided. At these low estimates there would, under favorable circumstances, enough young locusts hatch out to devour everything green, not only in the area stated, but over the whole United States, were they evenly disseminated throughout the country. We have already seen that the bulk of the eggs yet remain sound, and, notwithstanding such as have been destroyed by natural enemies and all other

causes, and such as have prematurely hatched, those yet to hatch will give birth to locusts enough, under ordinary conditions of weather, to lay waste the earth and render it as bare of vegetation as it is in midwinter, before they take their departure. This is not overstating the case, and the farmers of the threatened region should count on such a probability and do all in their power to avoid it.

The insects have already hatched out largely toward the Gulf, and the bulk of them will hatch in lat.  $35^{\circ}$  about the middle of the month. They will continue to hatch most numerous about four days later with each degree of latitude north, until along the 49th parallel the same scenes will be repeated that occurred in Southern Texas seven or eight weeks before. In the S. W. counties of Missouri hatching will be at its height about the second week in April; in the N. W. counties a few days later. Wherever they hatch in quantities, the injury will at first be confined to particular fields and locations; but as they increase in size they will become more and more injurious and widen the area of their devastations until, if nothing be done to prevent it, they will ruin most crops by the time the bulk of them acquire wings—leaving, in extreme cases, no plant untouched but the little *Amarantus Blitum*. This will occur in from six to eight weeks after hatching, and the winged swarms in South Texas will be leaving that country early in May or about the time the young are beginning to hatch near the British American line.

The unfledged locusts will travel in no especial direction, but in different directions, and they will not extend, on an average, more than ten miles east of any point where they hatched out. The winged insects, on the contrary, will take their departure in a northerly or northwesterly direction—at least, this will be the prevailing direction of those which rise during the months of May and June. The course of those which rise later may not be so constant. Those that escape from the many vicissitudes that will befall them in the Mississippi Valley, and which are free from disease or parasites when they start, will, in all probability, eventually reach the extreme Northwest, and be largely lost to view beyond our northern boundary. They will not fly eastward so as to do any serious damage beyond the line indicated in the map.

Such are the probabilities for the Spring and Summer. They are not particularly encouraging!

I will now state a few of the modifying circumstances and of the possibilities that will lighten the darkness of the picture and may very materially diminish the prospective damage.

*Firstly*—The farmers are in much better condition to withstand the temporary loss than they were in the Spring of 1874.

*Secondly*—They are far more thoroughly posted as to the prospects and better organized to fight the enemy. Correct information has been very widely circulated through the media of special reports and of the agricultural press. The bounty laws enacted during the winter will incite to action and will have a beneficial effect. The people are anticipating and preparing where two years ago they were comparatively indifferent. They are profiting by the experience of 1874-5. This is more particularly the case in Kansas, Nebraska, Iowa and Minnesota, and I regret to say less so in Missouri; for in some of our counties which are threatened, there is no organization and little preparation to meet the enemy.

*Thirdly*—I could not help noticing, and the same thing was remarked by many others, that quite a number of the insects observed last Fall, were much beneath the average size and generally darker than the typical specimens. Also a certain proportion of the eggs that I have received during the Winter, were far below the average size and much more predisposed to rot than the rest. I am strongly of the opinion that such specimens belonged to the swarms which developed in Minnesota and thereabouts, and which, after being repulsed in their efforts to get N. W., joined and formed part of the larger swarms which came from the farther N. W. The insects that hatched in Minnesota were in many instances the 3d and 4th generation bred there, and their degeneracy was very generally observed. Thus, expressions to the effect that the locusts there last Summer, were "used up," "tired out," etc., were common among farmers, and Mr. Whitman notes (Special Report for 1876, p. 12) the gradual decrease in the extent of the breeding grounds from year to year. More eggs have also rotted and the parasites have been more numerous there than elsewhere; while the injury has not compared to what it was in our State in 1875. The greater longevity of many of the insects of 1876 as compared with those of 1874, would also indicate that they were bred south of the region where the species is permanent and comes to greatest perfection. We may therefore expect that, as compared with 1875, a larger proportion of the young that will hatch in 1877, will be weakly and soon perish; for I know from my breeding experiments that there is great difference in constitutional vigor between them.

*Fourthly*—There is a bare possibility that, after the bulk of the young have hatched, and before they have commenced to do serious harm, we may have such unseasonably cold and wet weather as to kill them by myriads, and effectually weaken their power for injury.

*Fifthly*—Let the destruction be as complete as it well can, and



there is every assurance that the insects will vacate the country in which they were born, soon enough to permit the planting and harvesting of a great many of the more important vegetables, and with a favorable Fall, a good crop of corn. This is more particularly true of Missouri, and the country S. of the 44th parallel and E. of the 100th meridian, which country I have designated as outside the species' habitat. It is less true of the country W. and N. of those lines.

As to the prospects later in the year, it is impossible to predicate with the same degree of assurance. There were no locusts to do harm in Manitoba in 1876, and it would seem that the Saskatchewan country must have been more or less depleted by the swarms which overspread our country. I am inclined to hope and believe that there will not be another general invasion next autumn, and that the people of Texas, Indian Territory, Arkansas, Missouri, Kansas, Nebraska, Iowa, South Dakota and even Minnesota, may expect immunity for a few years to come; after the hosts which are about to hatch are destroyed or wing themselves away. There may be partial injury from their progeny in 1878, or even 1879, in parts of the country named, especially toward the N. W.; but there will be no general destruction. In Missouri we may confidently hope for immunity for from seven to ten years.

In conclusion, I would urge our farmers in the threatened country to prepare to carry out the recommendations given in this Report; to provide themselves with northern grown, early-ripening, seed-corn; to sell no hogs nor poultry; and to diversify their crops by growing more tuberous and leguminous plants.

In the language of the Omaha Conference report: "Above all, do not get discouraged! Come what may, do not ask for outside aid! We do not believe there ever will be any need of it: it is, in the end, demoralizing. \* \* \* \* \*

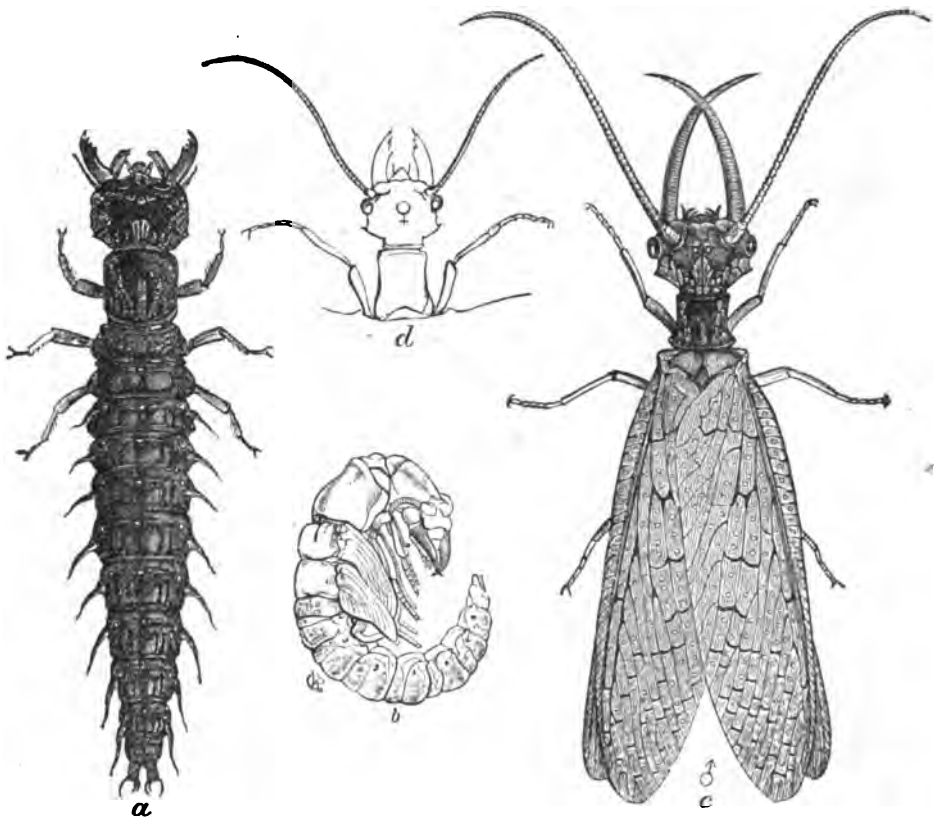
"There is no part of the country that is not subject to meteorological or entomological excesses, and in the long run the locust is not more injurious than are some insects in other parts of the country. When we think of the famine and utter destitution that at times overtake some of the Eastern peoples, we may well thank the Almighty that we live in a land of such resources and promise. The threatened country has prospered in the past: it will prosper in the future; and in proportion as we meet this locust enemy with enterprise and concerted, intelligent action, in that proportion shall we vanquish it."

# INNOXIOUS INSECTS.

THE HELLGRAMMITE.—*Corydalus cornutus* (Linn).

[Ord. NEUROPTERA ; Fam. SIALIDÆ.]

[Fig. 30.]



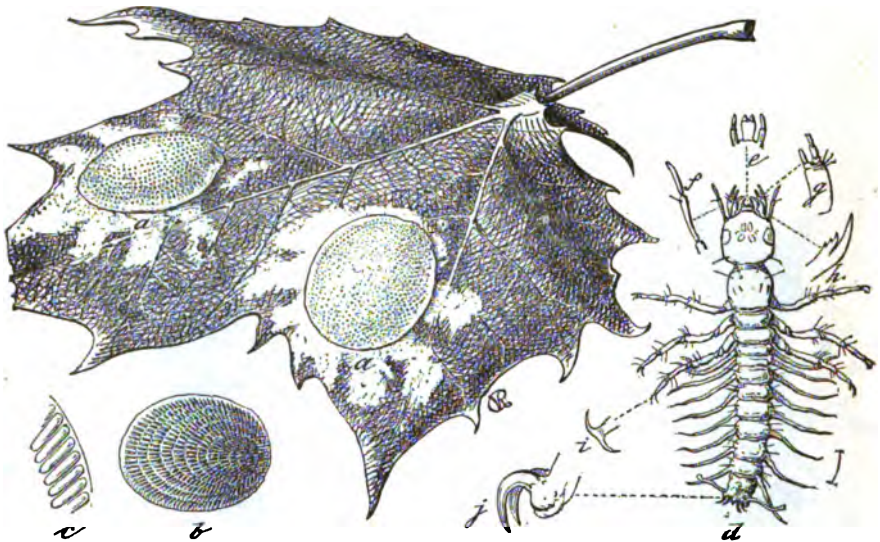
THE HELLGRAMMITE:—a, larva; b, pupa; c, male fly; d, head and jaws of female.

The following paper "On the curious Egg-mass of *Corydalus cornutus* (Linn.) and on the Eggs that have hitherto been referred to that Species," read by me at the last meeting of the American Associa-

tion for the Advancement of Science, will correct and supplement the article on the same insect published in my 5th Report :

Our largest Neuropteran, belonging to the family Sialidæ, is *Corydalis cornutus*. It is not uncommon in the Eastern and Middle States, and is known in the Mississippi Valley by the vulgar name of Hellgrammite. In the female the mandibles are quite formidable, but in the male they are curiously modified, and form long, incurved, smooth, prehensile organs of the form of the finger of a grain-cradle, and evidently of use in enabling him to embrace his mate. The larva of this fly occurs in running streams, living mostly at the bottom, and hiding under stones in the swiftest parts. It has strong jaws, and in addition to the ordinary stigmata, it is furnished with two sets of gills, one set lateral and filamentous, the other ventral, and each composed of a sponge-like mass of short rust-brown fibres.

[Fig. 31.]



CORYDALIS CORNUTUS:—*a*, *a*, egg-masses attached; *b*, one detached, showing lower surface—all rather below average size; *c*, a few eggs of the outer row; *d*, the newly-hatched larva; *e*, labium; *f*, antenna; *g*, maxilla; *h*, mandible; *i*, tarsal claw; *j*, anal hooks—all enlarged.

Its body terminates in two fleshy tubercles, each armed with a pair of hooks. It is best known in the full grown condition when, in seeking for a place in which to undergo its transformations, it travels and climbs on the shores of our rivers, and sometimes to long distances. Called a "crawler" by fishermen, it is greatly esteemed as bait. The pupa is quiescent and formed in a cavity in the ground. The supposed eggs of this insect were figured and described in the *American Entomologist*, and in the Fifth Missouri Entomological Report, as oval, about the size of a radish seed, and deposited in closely set patches of fifty and upward upon reeds and other aquatic plants; and they have since been frequently referred to, no one questioning the accuracy of the conclusion of their discoverer, the late B. D. Walsh.

About the middle of last July, in sailing up the Mississippi river between Bushberg and St Louis, my attention was attracted by sundry white splashes on the leaves of various plants that overhung the water; which splashes looked, at a distance, not unlike the droppings of some large bird. Approaching more closely to them, how-

ever, they were seen to consist of sub-oval or circular swellings, with more or less white splashed around them; and upon still closer examination, they proved to be egg-masses. They were generally attached one to the upper surface of a leaf either of Sycamore, Elm, Cottonwood or Grapevine; but sometimes there were several on the same leaf, and at others they occurred on both sides of the leaf. It was evident that the leaves were objects of attachment only, \* and from the fact that only those which overhung the water were selected by the parent, it was natural to infer that the species was aquatic in its larva state. Yet the egg-masses greatly puzzled me, as indeed they did all naturalists to whom I referred them; for the eggs of the larger water-beetles were known, those of *Corydalis* were supposed to be known, and there was only one other water insect in North America, viz: *Belostoma grandis*, large enough to be capable of laying such a mass. But these eggs were evidently not Heteropterous.

Patiently waiting till the eggs hatched, I recognised at once, in the young larva, the characters of *Corydalis cornutus*, with the full grown larva of which I was familiar; and upon dissecting the abdomen of a female Hellgrammite, the nature of the curious egg-masses was fully confirmed in the perfect identity in shape and arrangement of the eggs composing them, and of those in said abdomen.

The egg-mass of *Corydalis cornutus* is either broadly oval, circular, or (more exceptionally) even pyriform in circumference, flat on the attached side, and plano-convex on the exposed side. It averages 21 mm. in length, and is covered with a white or cream-colored albuminous secretion, which is generally splashed around the mass on the leaf or other object of attachment. It contains from two to three thousand eggs, each of which is 1.3 mm. long, and about one-third as wide, ellipsoidal, translucent, sordid white, with a delicate shell, and surrounded and separated from the adjoining eggs by a thin layer of the same white albuminous material which covers the whole. The outer layer forms a compact arch, with the anterior ends pointing inwards, and the posterior ends showing like faint dots through the white covering. Those of the marginal row lie flat on the attached surface; the others gradually diverge outwardly so that the central ones are at right angles with said object. Beneath this vaulted layer the rest lie on a plane with the leaf, those touching it in concentric rows; the rest packed in irregularly. Before hatching, the dark eyes of the embryo show distinctly through the delicate shell, and the eggs assume a darker color, which contrasts more strongly with the white intervening matter.

The young crawl from under the mass, and leave the vaulted covering intact. They all hatch simultaneously, and in the night.

The egg-burster† has the form of the common immature mushroom, and is easily perceived on the end of the vacated shell. The young larvæ crawl readily upon dry surfaces, with their tails hoisted in the air, and live for a day or more out of water; but when hatching out over an aquarium, they instinctively drop to the water, where, after resting for a while, with their bodies hanging down and their heads bent forward at the surface, they swim to the bottom by whipping the body from side to side very much as a mosquito wriggler does. Here they secrete themselves and remain until, in the course of a few days they perish. They cannot be reared in confinement, and running water is doubtless as essential to them as to the full grown larva.

The newly hatched larva is almost colorless and differs from the full-grown larva, in the relatively longer legs and lateral filaments; in these last being smooth and not

\* Since this was written, I learn from Mr. Lintner, of Albany, N. Y., that he has found these egg-masses attached to rocks in the Mohawk river, though he had no knowledge of their parentage.

† I am not aware that this special structure has been named: It is generally, if not always, a part of the ambion, and is common to many insects, though varying much in form. It may be known as the *ruptor ovi*. Dr. Hagen has called it the "egg-burster," while erpetologists designate as the "egg-tooth," a structure having the same purpose.

clothed with short hairs; in the abdomen not bulging at the middle, and in lacking the sponge-like gills beneath. The head is wider than the rest of the body, which tapers from the first to the last joints. The prothoracic is as long as, or longer, than the meso- and metathoracic joints together, and the abdominal joints increase in length as they diminish in width. The legs are nearly thrice as long as the width of the thoracic joints; the claws are movable and about  $\frac{1}{2}$  as long as the tarsus; the tibia and tarsus are sub-equal; the femur somewhat longer; the coxa and trochanter about as long as the femur; there is a whorl of bristles toward the end of the femur and of the tibia. The mandibles are stout, with two principle teeth, the basal with 3 notches and the terminal one finely serrate: the maxillæ are elongate, reaching beyond the jaws, and with a simple inner and a 2-jointed outer palpus, both having basal folds, which often look like a basal joint: the antennæ are 3-jointed, and reach beyond the jaws, the middle joint longest, the terminal one nearly as long, and tapering: the labium is elongate-quadrate, tipped with two small tubercles, and with the palpi 2-jointed—the joints sub-equal. A few hairs occur on the sides of the abdomen between the filaments.

The fact that the young larva lacks the spongy masses of short fibres which characterize the mature larva, and which have been looked upon as accessory gills, would indicate that their purpose is rather to assist the creature, when it gets large, in adhering to the surface of stones at the bottom of swift-flowing waters. Though the larva can live for some time out of water, even when young; yet, until it attains its growth it is strictly aquatic, abounding most in rapid flowing streams, and especially such as have a rocky bottom, upon which it crawls slowly about, feeding upon other aquatic insects, especially Ephemerid larvæ, some of which, taken from the stomach, I have been able to recognize as belonging to the genus *Palingenia*.

Mr. J. H. Comstock of Cornell University, [Fig. 32.] who has for several years studied the habits of this larva around Ithaca N. Y., generally finds it in the most rapid portions of streams, where it dwells mostly under stones. He has captured numbers by turning over large stones and allowing the current to wash the larvæ into a dip-net; and he is of the opinion, which my own observations support, that the species lives three years in this larval condition.

By carefully studying the anatomy of the species, he has also discovered an additional pair of rudimentary spiracles on the hind part of a prominent fold between the meso- and metathoracic joints.

As to the nature of the eggs (Fig. 32) that have hitherto been mistaken for those of *Corydalus*, I can only sur-

[Fig. 33.]



BELOSTOMA GRANDIS.

PROBABLE  
EGGS OF  
BELOSTOMA.

mise. The specimens from which the figure was made were destroyed with the Walsh cabinet in the Chicago fire; but I have a very distinct recollection of them, and judging from the nature of the eggs of *Perthostoma*, with which I am familiar, there is little doubt in my mind that these supposed eggs of *Corydalus* really belong to *Belostoma grandis*, (Fig. 33) which is the only aquatic Heteropterous insect of sufficient size to lay them.

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### THE YUCCA BORER—*Megathymus yuccæ* (Walker.)

[Ord. LEPIDOPTERA; Fam. HESPERIDÆ]

Having, during the year, reared this interesting butterfly from the egg, so as to watch its growth, I can supplement the article published a year ago by stating, positively, that there is but one generation annually, and that the characteristic glistening powder that covers the full grown larva, is not secreted till toward the last molt. The larva referred to on p. 181 of my Eighth Report, as being kept in a tin box, and fed solely on the leaves, lived till the 25th of September. It formed a perfect cylinder of silk and excrement around the bottom of the box, fastening thereto the ends of the cut leaves, so that the cylinder was necessarily broken each time the leaves were changed. This specimen went through no less than seven molts at irregular intervals of 10, 11, 24, 14, 61, 15 and 21 days respectively. It changed but little in appearance, except in becoming somewhat paler, after the second molt, and died when about three-fourths grown—death resulting, I think, more from the mould that formed from the excrement, and which it was impossible to prevent, than from the nature of its food. It is doubtful if so many molts are suffered in more natural and healthy conditions.

Another specimen that entered a Yucca plant in the garden of my friend, Dr. G. Engelmann, thrived admirably, extending over a foot beneath the ground, and attaining full growth by the end of September; while a third, in a potted *Yucca aloifolia* in-doors, hollowed out the entire root, pupated on the 26th of January, 1877, and gave out the imago on the 25th of the following month.

[illegible]

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## ERRATA.

- Page 6, line 26 insert after "moth" (*Euphanessa mendica*, Walk.)  
Page 15, line 3 for "entite" read "entire."  
Page 50, explanation of cut, for "e" read "c."  
Page 50, line 3 from bottom, for "Hubner" read "Huebner."  
Page 54, last line, in place of the comma, write "is."  
Page 55, line 1, for "the other" read "the second."  
Page 55, line 9 from bottom for "m. m" read "mm."  
Page 55, line 7 from bottom, strike out the "on."  
Page 56, line 1, for "m. m" read "mm."  
Page 56, line 2, for the last "and" read "anal."  
Page 56, line 32, commence a new ¶ with "Chrysalis" and italicize it.  
Page 57, for "*Spretus*" in the heading read "*spretus*."  
Page 58, line 14, strike out "have."  
Page 89, line 13, strike out the "i" after "embryon."  
Page 98, line 11 from bottom, for "*Compoplex*" read "*Campoplex*."















